BULLETIN **FIELD MUSEUM OF NATURAL HISTORY**

Volume 41, Number 1 January 1970

SHOUT
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EDEN REVISITED

A Tour of Britain and its Gardens

A few places still remain on Field Museum's tour, "Eden Revisited: A Tour of Britain and Its Gardens," according to Tours Chief Phil Clark, former editor of Horticulture magazine, who will lead the tour. Historic places, such as the Cawdor Castle of Macbeth fame, above, in northern Scotland will be among those featured. Price of the May 30-July 4 tour, including a $600 tax deductible donation to Field Museum, is $2,445. Reservations may be made by sending a $600 deposit check to: Natural History Tours, Field Museum, Roosevelt Road at Lake Shore Drive, Chicago, Ill. 60605.

(All photos by Phil Clark)

An ancient Rhododendron of historic importance is proudly pointed out by Mr. A. C. Gibson, owner of Glenarn, near Loch Lomond, Scotland. The great botanist-horticulturist, Sir Thomas Hooker, presented this Rhododendron to Glenarn 130 years ago; it was then a new creation of Hooker, who had crossed the Himalayan Rhododendron arboreum *with* R. catabiense *from all the way across the world, in the U.S. south, to produce it.*

Mr. David Hunt, of the Royal Society for the Protection of Birds in Cornwall, will lead the tour on a boat trip in the Scilly Islands area, to see puffins and other birds. The group will also visit Tresco Isle and its semi-tropical Abbey Gardens. During the 5-week tour, a variety of British specialists will address the group or spend from one to four days with it, including Mr. Roy Hay, garden editor of the London Times and author of the recently published "The Color Dictionary of Flowers and Plants;" H. F. W. Cory, a bird watcher of the Wiltshire Trust for Nature Conservation; Frances Perry, author of gardening books; Will Ingwersen, garden writer and nurseryman; Mrs. Poppy Davenport of the Scottish Garden Scheme, G. C. Colmer, naturalist of the National Trust for Scotland, and others. The tour will also feature archaeological sites. (Tresco Garden below).

SU-LIN

Super Star of the Thirties

by Patricia M. Williams

Lassie—a dog, Mr. Ed.—a horse, Flipper—a dolphin, and Gentle Ben—a bear, have all become national celebrities within the past few years. Their pictures stare out from cereal boxes, t-shirts, comic books and games. These animals all became famous via television, movies and big budget advertising, but in the thirties a sad-faced, roly-poly panda became equally popular without network or financial hook-ups.

On December 18, 1936 the giant panda, Su-Lin, arrived in San Francisco to a tumultuous welcome rivalling any given a human celebrity. In fact, "The final consensus of the press was that not since Bernard Shaw had a foreign celebrity received such a reception as Su-Lin." Again, on Su-Lin's arrival in Chicago the press turned out in full force as the public clamored to see the cuddly beast. On to New York and the crunch of bigger crowds and headlines. Su-Lin was undoubtedly a coast-to-coast sensation.

Why? Su-Lin had never made a movie, couldn't do any tricks and showed no signs of learning any. Granted the panda was cute and lovable, but the world was littered with cute animals and the press didn't accord them a reception on a par with Bernard Shaw's. The headline-grabbing news was that Su-Lin was the first giant panda ever seen alive by the Western world.

For decades following its official Western discovery in 1869 by Pére David, the giant panda was one of the rarest animals known to man. Again and again hunters unsuccessfully prowled the mountains of Szechuan in search of the elusive giant panda. Explorers yearned for just a glimpse of the living animal in the wild and for a time feared that it had become extinct. The difficulties of locating a panda only seemed to enhance its desirability and big game hunters considered it a supreme challenge.

In 1928 Colonel Theodore and Kermit Roosevelt, sons of Teddy Roosevelt, decided to take an expedition to Indo-China and West China with the main goal of killing a giant panda. Sponsored by Field Museum, the brothers vowed that they wouldn't return home until they had shot a panda and made a pact in which it was agreed that if a panda was sighted both brothers would fire simultaneously. In this way, they would share the distinction of being the first white man to kill a panda.

The party worked its way across the mountains between China and Tibet without detecting a whiff or a track of a panda. Undismayed, they moved on into Lololand—an area where explorer Lt. J. W. Brooke was murdered in 1910. The Lolos were apparently susceptible to the Roosevelt charm and instead of murdering them, helped the Roosevelts.

Finally, on April 13 the Roosevelts found giant panda tracks in the snow near Yehli, in the Hsifan Mountains. As described by the Roosevelts in *Trailing the Giant Panda*, ". . . Unexpectedly close I heard a clicking chirp. One of the Lolo hunters darted forward. He had not gone forty yards before he turned back to eagerly motion to us to hurry. As I gained his side he pointed to a giant spruce thirty yards away. The bole was hollowed, and from it emerged the head and forequarters of a bei-shung (giant panda). He looked sleepily from side to side as he sauntered forth and walked slowly away into the bamboos. As soon as Ted came up we fired simultaneously at the outline of the disappearing panda. Both shots took effect. He was a splendid old male, the first that the Lolos had any record of as being killed in this Yehli region."

The skin of this adult male panda was sent back to the Museum along with another specimen obtained from local hunters. The success of this expedition inspired other American museums to pack off panda expeditions to China and villagers who had seldom seen white men must have been amazed at the increased traffic of great white hunters through the mountains.

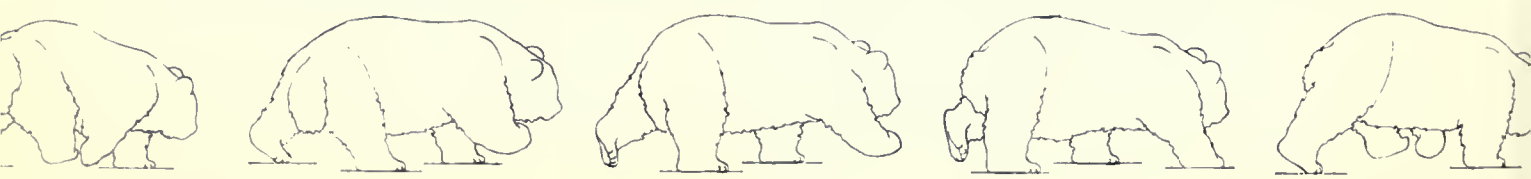
Floyd Tangier Smith led the Marshall Field Zoological Expedition to Southeast Asia from 1930 to 1932 and sent the Museum two more panda specimens obtained from Chinese hunters.

So far, all of the pandas arriving in this country were dead. Then, in 1934 William Harvest Harkness, Jr. left New York and his bride of two weeks determined to bring one back alive for the Bronx Zoo. Following a chain of disasters and delays Harkness found himself alone in China, his expedition in complete collapse. In February 1936 he died of a mysterious illness in Shanghai.

Harkness' bride, Ruth, a dress designer with no practical experience in hunting or collecting animals, was apparently an independent and adventurous woman. In April she left for China planning to take up her husband's expedition and fulfill his dream of bringing a live panda to the United States.

Four months later, Ruth Harkness was stalled in Shanghai trying to get an expedition going. Then she met the Young brothers, Jack and Quentin, a pair of American-born Chinese hunters. Together Ruth Harkness and the Young brothers gathered the necessary equipment and without "waiting for government red tape to be unwound," set off for the interior.

Following a 1500-mile boat trip up the Yangtze, the group endured a 300-mile overland trek best described as a travel agent's nightmare. Opium addicted porters and an unwanted bodyguard of 16 soldiers prefaced a stretch in which the former dress designer rode in a wheelbarrow. Fatigue and frustration mounted, but occasional clues kept



Left, Mei Lan at Brookfield Zoo in the early 1950s; right, "Happy" at the Leipzig Zoo. In his book Davis notes that young pandas are active and playful. Like many wild animals they may become surly and dangerous with age. One keeper at Brookfield lost an arm to Mei Lan. Davis quotes W. D. Sheldon, who hunted the panda: "My experience convinced me that the panda is an extremely stupid beast . . . Driven out by four dogs and warned by several high-powered bullets whistling about them, neither animal broke into a run. The gait was a determined and leisurely walk." This month's Cover is a profile of a giant panda, taken from Davis' book.

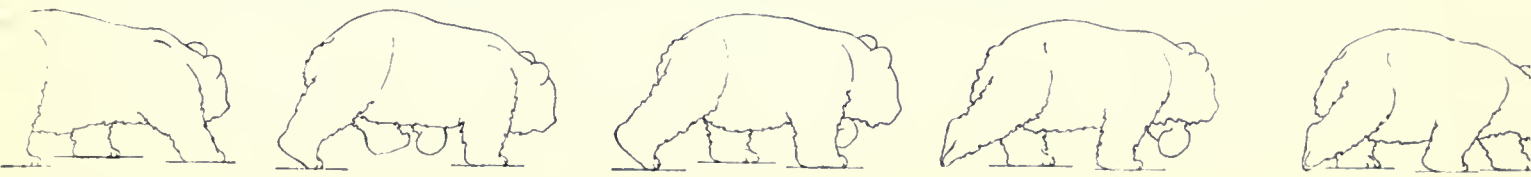
reviving their sagging hopes and the party pressed on. According to Desmond Morris in *Men and Pandas*, there is some question as to whether Mrs. Harkness actually captured the prized giant panda or merely bought it from Floyd Tangier Smith, an experienced hunter who led the Marshall Field Expedition in 1930–32.

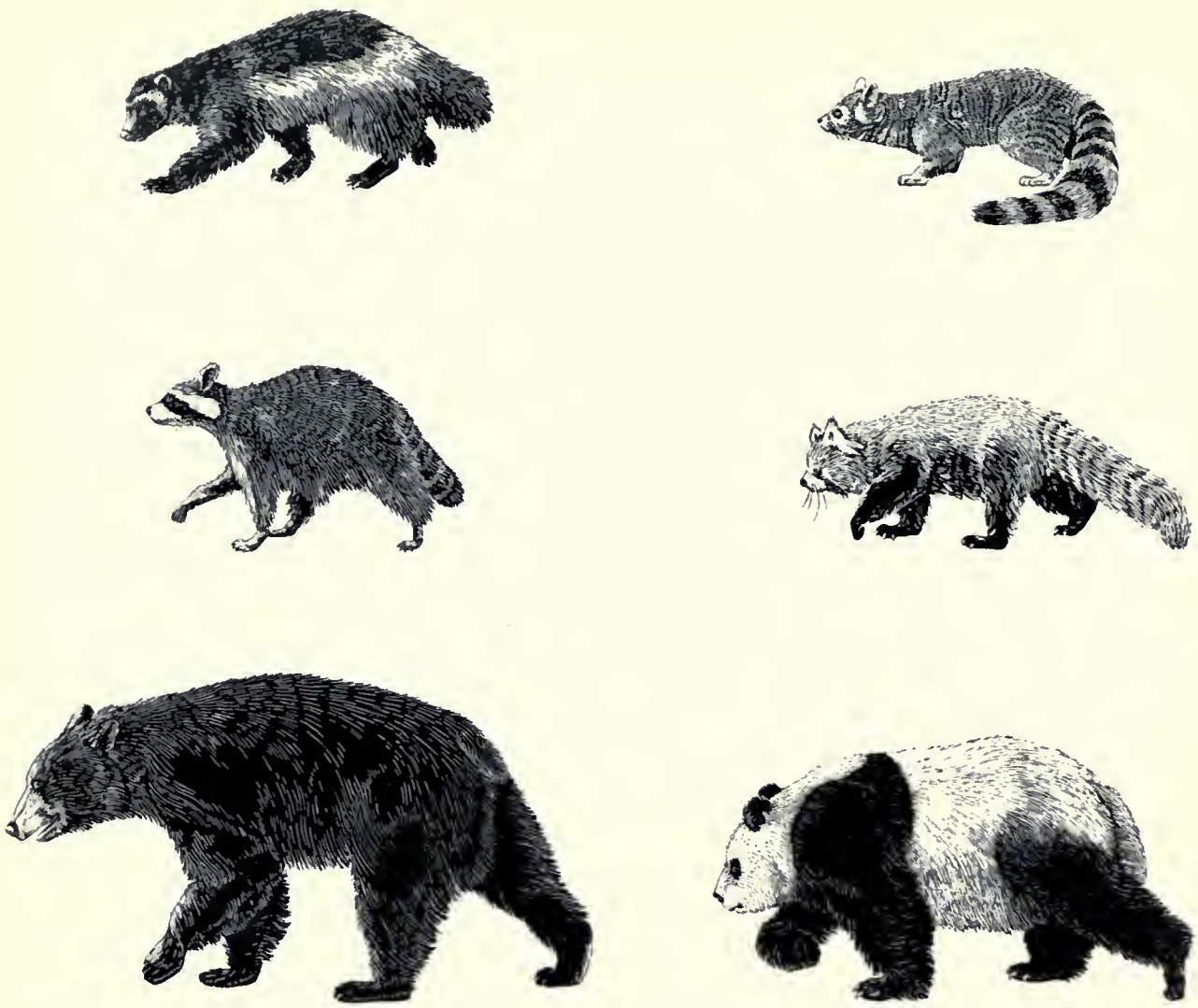
As Mrs. Harkness tells it, however, she and Quentin Young were pushing through a wet, dripping bamboo thicket when they heard a baby's whimper coming from an old dead tree. Mrs. Harkness wrote, "I must have been momentarily paralyzed for I didn't move until Quentin came toward me and held out his arms. There in the palms of his two hands was a squirming baby *Bei-shung*."

The long sought panda was hardly a giant. Not more than ten days old, it weighed less than three pounds. Ruth Harkness and the Youngs were as jubilant over their three-pound panda as if it had been 300 pounds. Mrs. Harkness named it after Jack Young's wife, Su-Lin, which, roughly translated, means "a little bit of something very cute."

Mrs. Harkness set about getting Su-Lin to the United States. Because of customs, Su-Lin's feeding needs and the press, this was no simple matter. One punster summed it up in a headline reading, "Panda-monium in Shanghai Customs House." But on December 2 Mrs. Harkness and Su-Lin, now tagged "One dog, $20.00," set sail for America and fame.

Even before the welcoming furor faded away, Mrs. Harkness was busy negotiating for a permanent home for Su-Lin. Chicago zoo director Edward Bean wanted Su-Lin but was unable to arrive at a satisfactory financial arrangement with Mrs. Harkness. Zoo officials in New York were reluctant to acquire an animal that they suspected was in poor health. Although she should have been accustomed to snags and delays by this time, Mrs. Harkness became depressed and wrote, "Was I a little insane, or had I just imagined that bringing a live Panda to America was worth anything to the great rich country of ours? When I had sunk to the lowest point of discouragement, the only thing





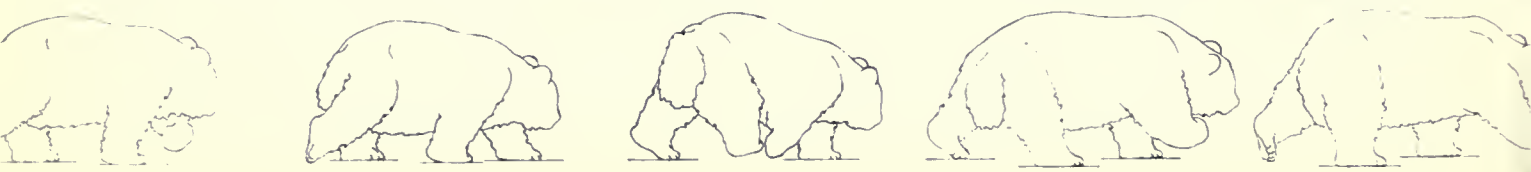
A drawing from Davis' book, "The Giant Panda," showing posture and body proportions of the panda and other arctoid carnivores. Top, left, Wolverine (Gulo luscus) *a generalized member of the mustelid family; right, cacomistl* (Bassariscus astutus), *a generalized procyonid. Middle, left, Raccoon,* (Procyon lotor) *and the lesser panda* (Ailurus fulgens), *both procyonids. Bottom, left, the black bear* (Ursus americanus) *and the giant panda* (Ailuropoda melanoleuca), *both ursids. The drawings are not to scale.*

I could think of that I wanted to do was to pack everything up, take Su-Lin and go back to the border of Tibet. And perhaps if I'd had sufficient money, I would have done just that."

According to a Quaker Oats ad which pictured an embracing Mrs. Harkness and Su-Lin, this "great American explorer" had discovered not just the "only Giant Panda in captivity," but a "nerve bracing breakfast" as well. With her nerves apparently well braced, Mrs. Harkness continued to work for a satisfactory financial arrangement and a good home for Su-Lin.

Meanwhile, Su-Lin, like all stars, was making personal appearances. Not only was the young panda a guest of honor at the New York Explorer's Club annual dinner, but a growing number of important people were becoming fans. The panda-killing Roosevelt brothers were easily charmed by Su-Lin and when Theodore was asked if he would like to see Su-Lin mounted and added to his group in Field Museum, he replied, "I'd as soon think of mounting my own son as I would this baby."

On February 8, 1937, almost two months after arriving in America, Mrs. Harkness got Su-Lin settled at Brookfield Zoo as a temporary guest. Then, two months later, the zoo contributed a satisfactory amount to Mrs. Harkness'



next expedition and Su-Lin became a permanent resident.

As Su-Lin grew fat and happy at the zoo, Mrs. Harkness was hot on the trail of a mate for the famous panda. Assuming that Su-Lin was a female, Mrs. Harkness searched the mountains of Szechuan for three months for a male panda. She finally returned with Diana, apparently a buddy, not a sweetheart. Unfortunately, Su-Lin and Diana's friendship was short-lived. In April 1938, six weeks after Diana's arrival, Su-Lin died when a piece of wood became lodged in the animal's throat.

On dissection it was discovered that Su-Lin was a male and zoo officials despairingly believed that they had had a breeding pair in Su-Lin and Diana. However, when Diana died in 1942 they found that she, too, had been a he.

Dead but not forgotten, Su-Lin was more than just another furry face. D. Dwight Davis, of the Field Museum staff, had often observed the panda at the zoo and on its death began a study of the panda that was to last the rest of Davis' life.

Using the embalmed and injected body of Su-Lin, Davis began his meticulously detailed and researched study of the internal and external anatomy of the giant panda. The original problem that motivated Davis' research was the determination of the giant panda's proper taxonomic position. Some workers insisted—and indeed still do—that the panda was a member of the racoon family, while others placed it in the bear family. As Davis stated, "the proper taxonomic position of *Ailuropoda* (the giant panda)—was soon settled; *Ailuropoda* is a bear and therefore belongs in the family Ursidae."

Davis made this statement in the Introduction to his enormous monograph "The Giant Panda" (*Fieldiana: Zoology Memoirs*, Volume 3, Dec. 7, 1964), but went on for 327 pages, making this one of the largest of the *Fieldiana* series, to a brilliant study in comparative anatomy. Davis made the work a test "based on the anatomy of the giant panda, of whether the comparative method can yield information that goes beyond the customary goals of comparative anatomy."

In achieving this goal, Davis gave careful consideration and discussion to each structure and organ of the giant panda. He worked with five artists and used 159 accurate and, in many cases surprisingly beautiful, figures to illustrate his subject. Almost all of Davis' illustrations and statements regarding the panda's soft anatomy were based on Su-Lin.

As Davis worked on his study, Su-Lin's hide went to the Museum taxidermists. And now, thanks to the taxidermists' skill, you can stroll down the Museum's Hall 15 and come face to face with one of the most famous characters of the thirties. (*Continued on page 8*)

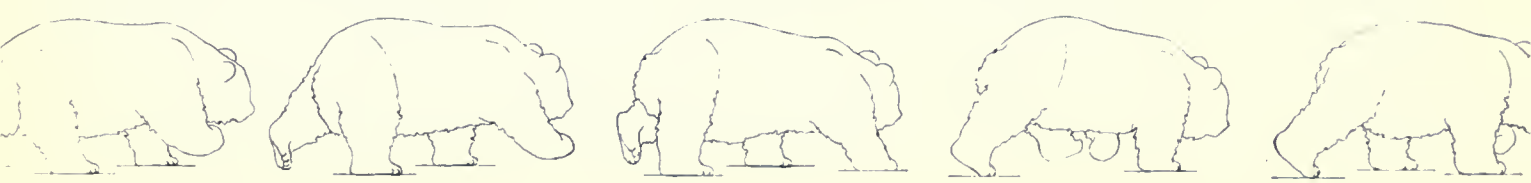
From Travel Book to Christmas Card

A rare travel book much sought after by collectors is John L. Stephens' *Incidents of Travel in Central America, Chiapas, and Yucatan.* There were a number of "editions" of this work,—probably only printings rather than editions. The copy in the library of the Field Museum is said to be the twelfth edition and is dated 1855, while my personal copy of the work is the "new edition" of 1842,—but in the preface mentioned as the tenth edition and issued three months from the time of publication of the work. The differences between these two "editions" are minor.

Mr. Stephens was a traveler and author, and I am sure that his Incidents of Travel must have been immensely popular, for he travelled in and wrote about a part of America that was not well-known in his day. The book was in great enough demand more than 100 years after its original publication so that a reprint edition of it was prepared.

Stephens took the artist Frederick Catherwood with him on his travels to Central America, Chiapas, and Yucatan. Catherwood sketched with great skill the ruins and artifacts of the Mayan civilizations long since disappeared, a few cities, and other things of interest. Steel engravings of Catherwood's sketches are to this day some of the finest and most artistic representations of Mayan "antiquities" to be found in any work. Certainly these engravings are responsible for much of the popularity of Stephens' Incidents of Travel and are what makes of it a collector's item.

Looking for a suitable subject for a Christmas card, we decided to have a sketch made after one of Catherwood's engravings. To simulate antiquity the sketch was engraved on copper with a mezzotint screen. It is of the highland Guatemalan city of Quezaltenango as it appeared about 130 years ago. Today Quezaltenango is one of the fascinating old cities of Central America. The city, its surrounding mountains and its Indian peoples are well worth a day or two of your time when next you go to Guatemala.—*by Louis O. Williams Chief Curator, Botany*



CALENDAR OF EVENTS

January hours: 9 a.m. to 4 p.m., Mondays through Fridays; 9 a.m. to 5 p.m., Saturdays and Sundays.

January 25 AUDUBON WILDLIFE FILM "MULE DEER COUNTRY," narrated by Buzz Moss, traces the fascinating life history of the mule deer against wildly beautiful scenery ranging from Canada to Mexico. 2:30 p.m. in James Simpson Theatre.

January 31 25TH CHICAGO INTERNATIONAL EXHIBITION OF NATURE PHOTOGRAPHY brings hundreds of award-winning wildlife photographs to the South Lounge of the Museum. Sponsored by the Nature Camera Club of Chicago and the Field Museum, the free display includes projection of winning color transparencies on two separate Sundays, 2:30 p.m., February 1 and February 8 in James Simpson Theatre. The exhibition continues to February 22.

Through February 28 WINTER JOURNEY "IT'S A ROCKY WORLD" is designed to teach youngsters the intrinsic and practical value of earth rocks. Any child who reads and writes may participate in this continuing self-guided program conducted by Raymond Foundation. Free journey sheets and information on the Journey program are available at Museum entrances.

Through March 1 ESKIMO MASKS: THE WORLD OF THE TAREUMIUT, a temporary exhibit of carved wooden masks produced by the aboriginal people of Point Hope, Alaska, gives insight to an aspect of their culture that is disappearing. The relationship between these hunting people, the animals they pursued, and their concept of supernatural powers is explained through artifacts from the Museum's collection and from the Sheldon Jackson Museum in Sitka, Alaska.

Continuing in January FIELD MUSEUM'S 75TH ANNIVERSARY EXHIBIT—A SENSE OF WONDER, A SENSE OF HISTORY, A SENSE OF DISCOVERY The three-part presentation showing the scope of the Museum's activities since its founding continues indefinitely in Hall 3. This dramatic exhibit includes many of the Museum's best specimens.

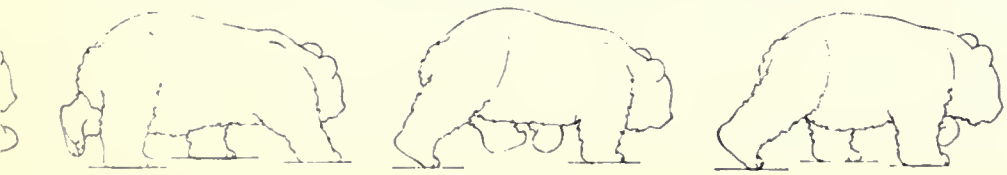
MEETINGS:

CHICAGO SHELL CLUB, January 11, 2:30 p.m.
NATURE CAMERA CLUB OF CHICAGO, January 13, 7:45 p.m.
FRIENDS OF OUR NATIVE LANDSCAPE, January 24, 2 p.m.
CHICAGO SHELL CLUB, February 8, 2 p.m.
NATURE CAMERA CLUB OF CHICAGO, February 10, 7:45 p.m.
ILLINOIS ORCHID SOCIETY, February 15, 2 p.m.
FRIENDS OF OUR NATIVE LANDSCAPE, February 22, 2 p.m.

SU-LIN Super Star of the Thirties (*Continued from page 7*)

Seated in a glass case, Su-Lin looks like an oversized and appealing toy. Perhaps it's the shape of his eye-markings or merely the tilt of his head, but Su-Lin is a melancholy-looking creature and it's easy to understand why the world was captivated by him 33 years ago.

As they say in the fan magazines, Su-Lin's star burned brightly but all too briefly. Only 16 months old at death, the giant panda had made international headlines, inspired toys, books, advertisements and expeditions, and, most importantly, become the basis of an outstanding scientific study.



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Chicago, Illinois 60605
Founded by Marshall Field, 1893

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BULLETIN **FIELD MUSEUM OF NATURAL HISTORY**

Volume 41, Number 2 February 1970

Field Museum's moon model acquired in 1898 and (lower right) NASA photograph of moon taken by Apollo astronauts

FIELD MUSEUM's natural history tour program is slightly over two years old. Since its inception in late 1967 with a tour highlighting the gardens, the people and the Mayan archaeology of Guatemala, subsequent tours have included Mexico, Brazil and Grand Canyon. At this moment, there are 30 enthusiastic travelers on the "Himalayan Kingdoms and Northeastern India" tour.

Field Museum's tours are designed to bring its members into closer contact with the Museum. The specialists from the Museum's staff and other persons accompanying the groups are experts in their field. An unforgettable experience is offered the traveler with this concentrated emphasis on the natural sciences.

Other tours this year include "Eden Revisited: A Tour of Britain and Its Gardens," May 30 – July 4 and a visit to Guatemala, October 23 – November 8, repeating the very popular 1967 visit

The tour described below covers "The Inca's Empire and Darwin's Galapagos." Mr. E. Leland Webber, Director of Field Museum, in commenting, stressed the aptness of the area for Field Museum, both because of the Museum's long commitment to the area and because of its inherent natural history importance.

Field Museum, he pointed out, is doing the definitive work on Peruvian plants, a work in progress for nearly 50 years, and is also doing a survey of Peruvian plant resources. The Museum's archaeologists and zoologists also have a long history of study and work in the area.

The Inca's Empire and Darwin's Galápagos

By Phil Clark, Chief, Field Museum's Natural History Tours

Photos by Phil Clark

Impressive Machu Picchu—the mysterious lost city of the Incas, stands on the sides and slopes of two mountains. It was believed to have served as a refuge for Inca nobility after Spanish conquest and was probably originally intended as a fortress.

The riches of the Inca's empire which left even Spain's swashbuckling *conquistadores* dazzled, haven't dimmed. Though today's tourists won't find Cuzco's fabled gardens of gold—those were melted and carted off to Spain—they discover treasures as impressive. There are mysterious ruins of masterfully-fitted stones among snow-topped mountains, cobalt lakes, designs etched in walls of adobe temples in the desert by the sea, handsome, poncho-wearing Indians speaking musical Quechua or Aymara, fantastic flowering plants with a new flora every couple thousand feet of elevation, and the artistic glory of Spanish colonial churches, paintings, and sculpture. It excited the *conquistadores'* greed—it will stimulate your sense of wonder.

But besides the Andean scenery of Peru, Bolivia, and Ecuador, Field Museum's tours, one group on December 31 to January 29 and the other, February 4 to March 5, 1971, see the gold of the Chibcha in Bogota and spend eight days cruising the Galapagos Islands, where Darwin was so amazed by the plants, birds, and reptiles that he framed a whole new concept of natural evolution.

The 30-day tours, limited to 30 persons each, including all expenses except tips and including a $600 tax deductible donation to Field Museum, cost $2,807. An archaeologist and a botanist are along to interpret the marvels of man and flora and a zoologist accompanies the group to the Galapagos. Private homes and gardens open to the tours in leading cities and museum officials greet them. For those with limited time, the Inca's Empire portion of the tour is offered separately. The 22-day tour, without the Galapagos, ends on January 21 and February 25, and costs $350 less, or $2,457.

Chan Chan ruins, near Trujillo in northern Peru, on the Pacific, still show original carvings of penguins etched in adobe.

First Day: You fly from O'Hare Airport, arriving in Bogota in the evening. Your hotel is the luxury Tequendama (unless otherwise indicated, meals are in your hotels).

Second Day: Thousands of delicately wrought gold pieces made by the Chibcha and other Colombian Indians are displayed in modern settings at Bogota's Museo de Oro—these are some of the indigenous treasure that missed the Spanish king's royal smelters. You also view what the Spanish created in exchange: the magnificent mahogany carvings and the expressive paintings of the San Francisco and Tercer Orden churches. During the afternoon you visit the handsomely Spanish modern garden and home of Dr. Adolfo Tamara, an outstanding Bogota physician, and the colonial gardens and house in which Simon Bolivar, the liberator of most of South America, lived. This evening you fly to Lima where you stay at the palatial Hotel Bolivar.

Third Day: More of the treasures the Spaniards missed, these of the Incas and their predecessors, the Chavin, Mochica, Paracas, Nazca, Tiahuanaco, and Chimu cultures are displayed in the National Museum of Archaeology and the private collection of Rafael Larco Herrera, here in Lima. During the afternoon, you tour the city.

Fourth Day: Out in the desert north of the city are the adobe ruins of the vast city of Cajamarquilla which reached its prime in the seventh century, 400 years before the Incas, and of Puruchuco which was an Incan government center and has been restored. Lunch is at the home of Sra. Josefina Heudebert de Rodriguez. During the afternoon, you view the home and garden in semi-colonial style of the Chilean Ambassador, in the San Isidro section, and the private orchid collection, including native species, of Sr. and Sra. Victor Vizquerra, in Miraflores.

Fifth Day: You view the unusual gardens and interesting plant collections of Mr. W. L. C. Tweedle at Hacienda Matazango in Lima's Los Leones suburb and the effectively designed home and garden of Sra. Lucila de Li, in El Derby. In the afternoon you visit the National Museum of Art. Dinner is at the Trece Monedas.

Sixth Day: In the desert, south of Lima, is the adobe pyramid-temple of Pachacamac, on a bluff overlooking the Pacific. After lunch, you see probably the largest collection of Inca and pre-Inca gold in the world, thousands of pieces, many of exquisite workmanship, at the Museo de Oro. Dinner is in another converted Spanish mansion, the newly opened Tambo de Oro.

Seventh Day: Today you fly to the city of Trujillo, north of Lima. At Chan Chan and the Palace of the Gran Chimu, you see etchings of pelicans, fishes, squirrels, moons, and geometric designs ornamenting great halls and long passageways centuries ago; many are nearly as sharp today as they were when inscribed. The Huaca El Dragon features great storage bins for corn and cotton and adobe carvings of dragons and warriors. Lunch is at the Pacfic beach, Las Morillas. You watch reed boats, caballitos del Mar, at Puerto Huanchaco, then fly back to Lima in late afternoon.

Eighth Day: This morning you fly to 11 thousand-foot high Cuzco, once capital city of the great Inca empire. You settle in the pleasant Hotel Cuzco and rest for a couple of hours or so to adjust to the altitude. After lunch, you tour the great Spanish colonial churches, taking interested notice of the unique Cuzco painting style.

Ninth Day: During the morning you walk through some of the areas of Cuzco where Incan-fitted stones are still evident in building foundations and where the great centers existed in the old city. After lunch you ride to ruins in the mountains which circle the city: the great rocks of the fortress which guarded Cuzco, Sacsahuaman, and to Tambumchay, Puca Pucara, and K'enco. After dinner, you attend Peruvian folk dances performed by a youthful, local group, the Centro Qosqo de Folklorico.

Tenth Day: You travel to the Indian market village of Chinceros, where, even more than in Cuzco, Quechua is the prevailing language. You pass Lake Huaypo and reach your hotel, the Urubamba at Urubamba, for lunch. Later you visit the mountainside ruins of Ollantaytambo temple and fort.

Eleventh Day: You leave Urubamba Hotel, traveling back to Cuzco via the Indian town of Calca, where the church features a striking folk art cross, and along the Urubamba River, remarkable for the cacti and bromeliads in its cliffsides and to the Indian market town of Pisac, where alpaca and llama wool products are excellent bargains as is the indigenous pottery. You dine at the Hotel Cuzco.

Twelfth Day: An early morning train takes you through several climatic and floristic zones over the mountain rim above Cuzco and down 65 miles to the Urubamba River, then, by bus, up five miles to the 7,800-foot elevation, "lost city" of Machu Picchu, where a great and mysterious

Inca center is spread over two mountain tops. The amazingly perfect fitting and facing of gigantic rocks leaves you in awe and puzzled over how these great stones were transported by people who knew no wheel. You spend the night at Machu Picchu Hotel.

Thirteenth Day: Early risers will stroll among the ruins, to get photos unobstructed by people and to bird watch. During the morning, a bus will take birders and plant enthusiasts the five miles down to the Urubamba River where flora is semi-tropical: a special treat—the long, scarlet eardrops of the shrub, *Fuchsia boliviana.* During late afternoon, you take the return train to Cuzco.

Fourteenth Day: Another fascinating train trip—from Cuzco through valleys and mountains, past lakes and towns where Indians wear colorful regional dress and the women the universal derby hats which originated here. Then into highland slopes where thousands of llamas and alpacas herd and finally to the town of Juliaca, where you are driven to the ruins of Sillustani. At last, over a mountain rim and you view the vivid turquoise blue of Lake Titicaca—world's highest major lake, at 12,697 feet. You stay at Tambo Titikaka Hotel.

Fifteenth Day: Birders will be out early to observe water and lakeside birds. There will be an opportunity for fishing and an outing to the Catcha-Catcha ruins. Mainly, it will be a day of relaxation with all activities optional.

Sixteenth Day: Fusion of the art of Aymara Indians and of the Spaniards produced some unusually handsome cathedral churches in the Aymara towns of Juli and Pomata, which you visit on your way to the Bolivian city of Copacabana, where the famous church of Our Lady of Copacabana is located. You board the hydrofoil ship to cross the lake, stopping at Moon Island and Isla del Sol with its Incan ruins and to see the fishermen in their oriental-looking reed boats. You drive from the other side of Titicaca to La Paz, capital of Bolivia, at 13,000 feet, arriving in time for dinner at the skyroom of the comfortable Hotel Crillon.

Seventeenth Day: After viewing the magenta and yellow bells of the *Cantua buxifolia,* national flower of Bolivia, in the small but beautiful Botanical Garden, you visit San Francisco Church and the colorful vegetable market, then are driven to the mysterious ruins of Tiahuanaco, with its inscrutable great stone figures, carefully fitted rock ramps, and carved stone gateways. After a picnic lunch at the ruins site, you return to La Paz.

Farmers dress warmly in the highlands of Peru, near Cuzco.

Eighteenth Day: You fly to Quito, Ecuador. After settling in luxurious Hotel Intercontinental Quito, you visit the Casa de Cultura, which gives a summary of the whole history of ancient and colonial Ecuador.

Nineteenth Day: You visit the charming blend of colonial and modern garden and home of Sra. Clara de Andino and the Colonial Museum with its distinctive Quito-style religious sculpture and painting. In the afternoon, you tour the great Spanish Colonial churches and the central plaza.

Twentieth Day: You are driven from 9,000-foot high Quito down through three distinctive floras to Santo Domingo de los Colorados, in tropics at 1,000 feet. You ride and walk through the jungles to the homes of the Colorado Indians, who coat their hair with a red dye made from *Bixa orellana,* the annatto seed, and who paint their faces and bodies. We are greeted by three families, each in a separate clearing—the Colorados live separately in a self-governing colony of the about 600 remaining members of this unique people, different linguistically and culturally from Ecuador's other indigenous peoples. The women are bare breasted and paint their hands black. On the trip back to Quito, you make a few roadside stops to see flowering plants including varied orchids, fuchsias, passionflowers, angel's trumpet trees, and a tropical relative of the heather, *Tibaudia acuminata,* with showy red, yellow, and green blooms.

Twenty-first Day: This morning you visit another home and garden of a prominent Quiteno. In the afternoon, you view the newly opened, modernly displayed Archaeological Museum of the Central Bank of Ecuador. Dinner is at La Choza, for typically Ecuadorian food.

Twenty-second Day: You drive through the mountains to the highland Indian market center of Saquisili, where Quechua is the principal language. Basketry and textiles are outstanding.

Twenty-third to Thirtieth Days: You fly to Baltra Island in the storied Galapagos, where you board a new, 1,000-ton, 60-passenger yacht, the Lina A, a floating luxury hotel. It is air conditioned and carpeted throughout. Our cabins are on the upper deck.

These islands, which so excited Charles Darwin, straddle the equator but are not hot. The isolation, which has made the islands difficult to reach in the past, created a strange natural laboratory which vividly demonstrates Darwin's theory of evolution.

(Continued on page 10)

.....EARLY RETURNS ON THE LUNAR SAMPLES.....

Bringing the moon to Field Museum made headlines in 1898 and, now, again in 1970 as actual lunar samples were placed on display. In this article Dr. Edward Olsen, the Museum's Curator of Mineralogy and a member of a team studying the lunar samples here in Chicago, discusses some of the preliminary findings of the lunar research groups. If you wish to pursue this matter in greater detail, see a late January issue of Science *journal. Also, the surprising and little known story of the history of the Museum's moon model now on display in Hall 35 is told on page 9.*

by Dr. Edward J. Olsen, Curator of Mineralogy

The Field Museum was fortunate in being able to have one of the world's first two exhibits of Apollo XI lunar samples. The exhibit, which ran from Oct. 9 through Nov. 9 and again from Dec. 26 to Jan. 4, was made possible through the courtesy of a group of six faculty members of the University of Chicago: Joseph V. Smith, Edward Anders, Robert Clayton, George Reed, Anthony Turkevich, and Stephen Hafner. Drs. Smith and Anders are both Research Associates at the Museum. The National Aeronautics and Space Administration (NASA) made the exhibits possible and financial assistance was provided by the Field Foundation of Illinois.

Having had several months now to work with these samples, the time has arrived to sum up some of the initial findings. The National Aeronautics and Space Administration (NASA) scheduled an open public session during the first week in January to discuss the preliminary results. Each of the 141 principal investigators was there along with members of their respective research teams. The meeting, held in a downtown Houston hotel, was referred to by some of the investigators as a sort of lunar "show-and-tell." It was thought that some of these preliminary findings would be of interest to the members of the Museum.[1]

Over the past several years three unmanned vehicles of the Surveyor series have been instrumented with an extremely clever little device about the size of a cigarette package. This instrument, which has the very pretentious name of an *alpha-scattering chemical analyzer*, was conceived designed, and built by Drs. Anthony Turkevich (University of Chicago) and James Patterson (Argonne National Laboratory). The device, when lowered to the lunar surface, accumulates data on the chemical elements making up the surface on which it rests. The area it analyzes is only about a square inch. These data are stored in a small computer attached by cable to the analyzer and then transmitted by radio back to earth on command.

[1] If you wish to pursue this matter in greater detail, see a late January issue of *Science* journal.

From these three analyses it was already clear before the Apollo XI landing at Tranquility that the lunar surface was not everywhere the same. In fact, two of these analyses showed anomalous features no one would ever have predicted. The third analysis was *just* what many had predicted already (for, however, the *whole* lunar surface). The Tranquility site was less than 100 miles from one of the Surveyor sites (also in the Sea of Tranquility) that had shown a very peculiar composition. It was impossible to say, however, whether the analyzing device happened to come to rest on a peculiar and non-typical patch, or if the reported data was a true representation of the average rock material there.

The Apollo XI samples have settled this question and in so doing have raised a bigger question. Analyses show the lunar samples have the same unusual composition as this nearby Surveyor analysis. These rocks have extraordinarily high contents of the chemical element *titanium* and are very low in the element *sodium*, in contrast to the type of rock called basalt, which most of the investigators would have predicted would be found, if they were forced to make such a prediction ahead of time. The titanium content of a normal basalt is generally a few tenths of a percent, while the Tranquility rocks have between 6 and 12 percent! In other words, it is 50 to 100 times higher in titanium than basalt. The sodium content of normal basalt is usually about 2 percent. The Tranquility samples have only a few tenths of a percent of sodium, or about ten times too low for basalt.

Field Museum President Remick McDowell (left) *and City of Chicago Commissioner Jane Byrne* (right) *confirm the samples brought to the Field Museum by Prof. Joseph V. Smith* (center).

The unusual composition, of course, reflects the presence of unexpected minerals. The most prominent of these is the mineral called *ilmenite*, which is an oxide of iron and titanium. The other main mineral constituents are plagioclase-feldspar, several types of pyroxenes, and very minor amounts of olivine.[2] All of these minerals are known from different rock types here on earth, however, the rock type containing all of them in the observed proportions is rare here on earth.

These samples are not the expected basalt, but what are they? Three main rock types are present. One is a coarse-grained rock with numerous ilmenite-crystal-filled cavities called an *ilmenite-pyroxene-gabbro*. The second most prominent rock is a very compact, fine-grained rock called a *microbreccia* (pronounced "my'-krow-bretch'-ee-ah"). This rock is made up principally of fragments and chunks of several rock types that are held together in an extremely fine-grained matrix of pulverized rock material. In this rock are blebs and threads of silicate glass (i.e., silicate rock that was melted and cooled so rapidly that no mineral crystals had a chance to form). The final major rock type is the so-called lunar "soil," which consists of loose, powdery to gravelly, pieces of the former two rock types. The soil contains abundant loose silicate glass blebs that are generally spherical, but may be misshapen also. These blebs, or beads as they have been called, range in color from clear and colorless to greens, yellows, browns, and black. Dark brown is the most common color. Many of these beads are hollow and some show small holes made by gases once contained inside them that blew open the holes and escaped when the glassy blebs were still soft and molten. In addition to the brown glass, the soil and rocks commonly have brown to black glass spattered over them in irregular patches.

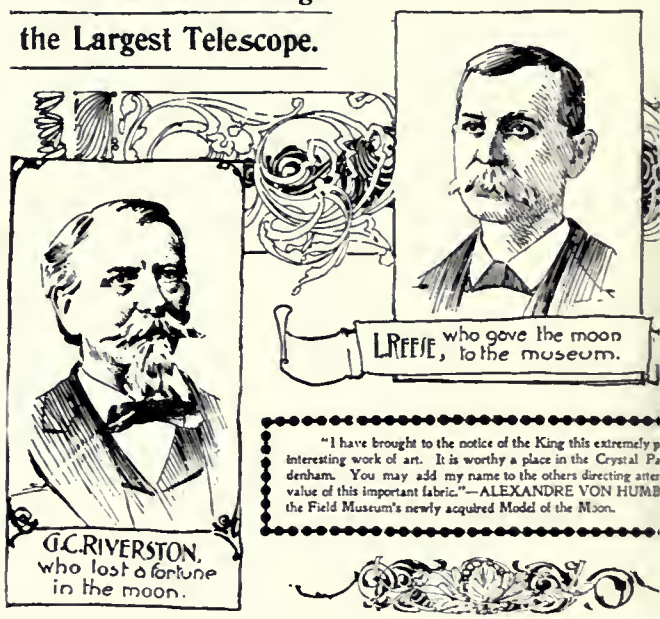
[2] For the reader who may be a mineral collector or rockhound, a more complete list of minerals found in these lunar samples accompanies this article.

Pages 49 to 56.

The Chica

FIELD MUSEUM SECURES

This Wonderful Model, Which Cost a Chicago
His Fortune, During Ten Years Was Held
for Storage Charges. It Will Enable Chicagoan
to See Earth's Satellite More Distinctly than Th
Could See Her Through
the Largest Telescope.


G.C.RIVERSTON,
who lost a fortune
in the moon.
L.REESE, who gave the moon
to the museum.
"I have brought to the notice of the King this extremely p
interesting work of art. It is worthy a place in the Crystal Pa
denham. You may add my name to the others directing atter
value of this important fabric."—ALEXANDRE VON HUMB
the Field Museum's newly acquired Model of the Moon.

Little Tammy Lord is captivated by the moon rock as are her mother Mrs. Nancy Lord (left) *and Mr. and Mrs. Newell Chiesl.*

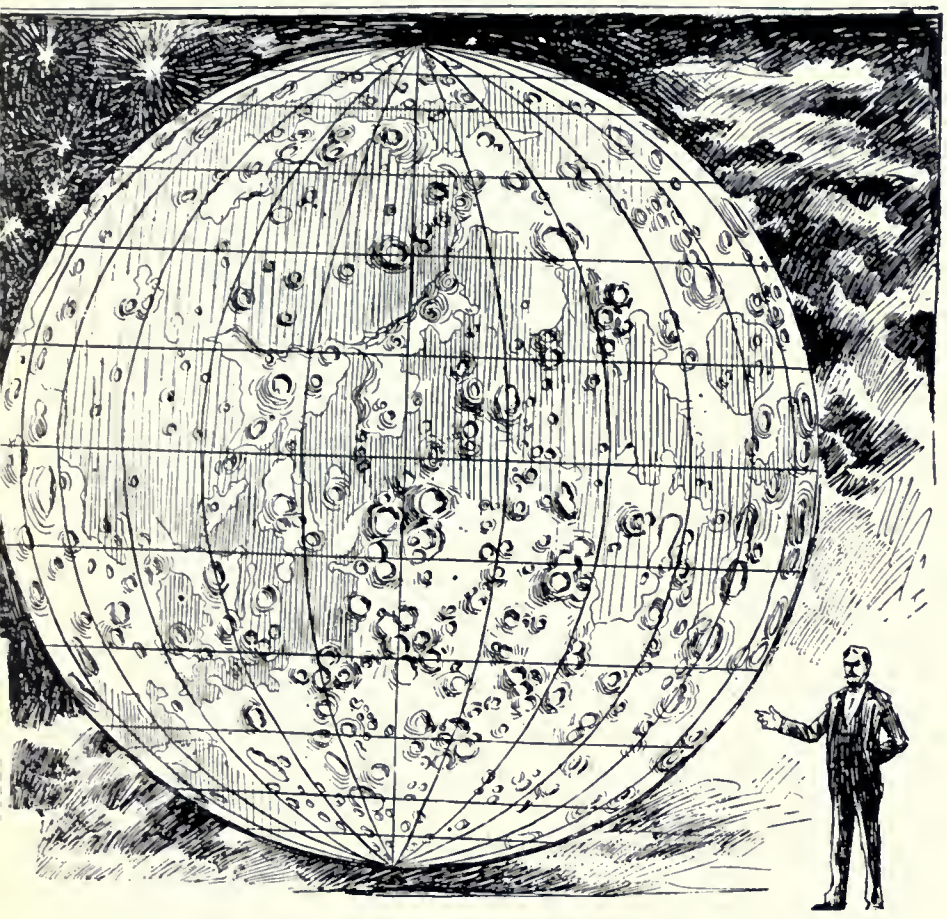
Both the glass beads and the spattered glass appear to be the result of meteorite impacts. High velocity meteorites impact the lunar surface with such energy they literally explode and vaporize, melting bits of the rock which they hit. The melted silicate bits that are thrown upward round themselves into spherical droplets and harden as they fall down to the surface. Melted material thrown sideways hits adjacent rock projections and forms the splatters that are observed. On earth the vast majority of meteorites that actually hit the surface (i.e., those that are not burned up completely in our atmosphere) have been greatly slowed down by friction with the thick earth atmosphere. These merely "plop" onto the surface and do not explode. With no atmosphere on the moon all meteorites hit with the high velocity they have in space, approximately 17 kilometers per second (or about 37,000 miles per hour).

Interestingly, it has been possible for some investigators to determine the average type of meteorite material that has caused these lunar explosions. The result would not have been predicted. The average meteorite hitting the moon appears to be close in composition to carbonaceous stone meteorites, a type which is extremely rare here on earth. This leads to the speculation that they may be a very common type in space. Because of their crumbly, weakly-bonded nature we know they cannot survive the transit through our atmosphere very well. Hence, our atmosphere may be acting like a kind of filter that lets through only the harder, durable meteorites, like common chon-

Sunday Tribune. PART SIX.

RIL 3, 1898—SIXTY PAGES.

ANTIC MOON LONG LOST IN CHICAGO.



Field Museum visitors Bob Sailor of Elkhart, Indiana and Gail Courtright of Highland Park, Illinois, took time to really take a good look at the Apollo 11 specimens.

drites and irons, which may actually be rare in space. The carbonaceous ones, which may be the most common in space, are burned and destroyed as they pass through earth's atmosphere, except in rare instances. Thus, we may have had a very slanted statistical view of the types of meteorites in our solar system, and hence, of the chemical history of the system.

The rock called microbreccia is still a bit of an enigma. Microbreccias of greatly different compositions are known on earth but *they* do not help us much to understand these. Bits and pieces of various unusual rock types are contained in these lunar samples. Whether these bits of rock represent layers below, or rocks exposed on the surface in surrounding areas is not known. The make-up of this rock, however, indicates it is the result of meteorite impact explosions, which produced these unmelted fragments as well as the glasses. The fragments clumped together along with glass and pulverized rock as a matrix and formed the microbreccia we find today.

The ilmenite-pyroxene-gabbro, however, has all the earmarks of a more normal igneous rock. Except for the unusually high ilmenite content and extreme mineral zoning in the pyroxene, it looks like some terrestrial gabbros.

Studying the minerals and rocks, comparing and contrasting them to terrestrial rocks, is only one approach to these samples. Some investigators are looking at various chemical trace elements. So far their work indicates that those trace elements which vaporize easily are in extremely low abundance. Those which are difficult to vaporize are present in larger amounts. This is taken to indicate that the rocks have had a high temperature history that allowed easily vaporized elements to do so and then to escape to space, the rocks retaining the less volatile ones.

Some chemists have studied the various kinds of each chemical element present, that is, what are called isotopes. From the isotopes of oxygen it is also concluded that the rocks have had a high temperature history, around 2,000° to 2,200° F. at one time.

Probably the most startling result is that obtained by those investigators measuring the age of the rocks using so-called radioactive clocks. The date obtained for these Tranquility rocks is 4 billion, 500 million years old. This is almost exactly the age which all the stony meteorites give. The earth, calibrated against meteorites by a very ingenious means, is considered to be about 4 billion, 700 million years old, or about 200 million years older.

Now the earth has had a very complex history, whereby it separated out into major layered zones called the core, the mantle, and the crust (on which we live). Rocks of the crust took time to form, hence, we would expect ages of crustal rocks to be younger than the earth as a whole. Indeed, the oldest known crustal rock is only 3 billion, 300 million years old. Thus, the crust took about 1 billion, 400 million years to form. If we assume the moon, as a whole, to be as old as the earth then the rocks of its surface in the Tranquility area separated for only 200 million years,

and nothing has happened since! This area of the lunar surface has been geologically dead for 4 billion, 500 million years! Compared to the earth, it has had a relatively short geologically active history.

The age indicates that the moon is definitely a part of our solar system, formed at about the time the system coalesced around the primitive sun. Some have speculated in the past that it may have been an object captured by the earth and from a different part of space. The age also rules out the notion that the moon was torn from the earth, leaving behind a vast depression which became the Pacific Ocean.

The age is expected to vary in other parts of the moon. Every time a rock is reheated and recrystallized its radioactive clocks are reset to zero again. Over the past decade astronomical observatories in both the U.S.S.R. and England have seen red glares on the surface that persist for a few hours and then fade. These have been interpreted as lava flows from volcanic activity. If so, then samples of these recent lavas, if ever collected, would give an age of only a few years. Presumably, rocks of all intermediate ages from the present back to 4.5 billion years could be found in restricted areas also. What is significant about the age of the Tranquility samples is that the so-called "seas"[3] are as old as the solar system. It has long been speculated that the seas are the oldest geological features of the lunar surface. This is now borne out by the age determination.

This is only a summary of some of the kinds of results obtained so far on the lunar samples. Many of the investigations are employing methods that would be impossible to describe in the space we have here. Indeed, every instrument of current science is being turned to work on lunar specimens. The results described here present a fairly consistent picture of a very old object that ceased most of its activity early in its life and has been subsequently modified by high energy meteorite impacts. It must be pointed out that all the data coming in are not so consistent, and some results are entirely contrary to the picture presented here. Such apparently contrary bits will ultimately fall into place, or cause the whole picture to be changed in a way no one would ever have imagined. That, of course, is the fun of any excursion into the sciences. ■

[3] These huge areas were first seen by telescope by Galileo in the 1600's. He thought they were seas with water in them. We now know they are vast dry plains, however, the name *sea*, or *mare* in Latin, has stuck and is still used.

Michael Park (left) *and Angela Grandison are fascinated by the Apollo 11 samples displayed in December.*

List of minerals found to date in Apollo XI *samples:*

- Augite
- Chrome spinel
- Christobalite
- Ferroaugite
- Ilmenite
- Iron-nickel alloy
- Olivine
- Plagioclase-feldspar (bytownite)
- Pseudobrookite
- Pyroxmangite
- Schreibersite
- Quartz
- Tridymite
- Troilite

Dr. Edward Olsen (left), *Curator of Mineralogy, carefully transfers a piece of moon rock as August Teschendorf* (right), *Chief of Security, watches. Dr. Olsen and Mr. Teschendorf worked closely to insure security of the material shown at the Field Museum.*

THE MYSTERIOUS MISSING MOON OF GERMANY

by Patricia M. Williams
Field Museum Press

THE recent exhibits of the lunar samples do not mark the first time the moon and the Museum have made the news together. On April 3, 1898 the *Chicago Sunday Tribune* ran a banner headline announcing, "Field Museum Secures Gigantic Moon Long Lost in Chicago." In somewhat smaller type the rave continued, "This Wonderful Model, Which Cost a Chicago Man his Fortune, During Ten Years Was Held for Storage Charges. It Will Enable Chicagoans to See Earth's Satellite More Distinctly than They Could See Her Through the Largest Telescope."

Although the *Tribune*, the Museum and Chicagoans were pleased with the Museum's acquisition of "this wonderful model," the pleasure was not universal. In Germany the *Hanoverischer Courier* reported on January 14, 1899:

> "Time and again the complaint is made that the best efforts of German art take the way over the Ocean only because better paid for in America. Recently a scientific treasure has gone the same way, without anybody having been aware of it. Every astronomer is familiar with the relief of the Moon prepared by Joh. Fried. Julius Schmidt, assisted by Dickert, but most people thought that it was in Bonn, where Schmidt for 7 years was the assistant of Argelander. As late as 1896 a statement to that effect is found in an astronomical work. The fact is, however, that it has been in America for 20 years, but was exhibited so seldom that it had been lost sight of. Only recently has the public and the students of astronomy had access to it.
>
> Mr. Lewis Reese of Chicago had got hold of it, nobody knows how—and lately donated it to the Field Columbian Museum of Washington, where it has now been installed. The model is in the shape of a hemisphere, 19 feet in diameter and reproduces on its surface more than 20,000 different typographical features of the visible part of the moon. Schmidt himself published a description of his masterly work, guaranteeing the correctness of the representation.
>
> It cannot but hurt the patriotic feelings of a German to know that this still incomparable work is to be found in an American Museum, instead of in a German Observatory or University."

The matter, of course, was not as mysterious as the German press inferred. Mr. G. C. Riverton, who was said to possess a considerable fortune, saw the moon model in Bonn, Germany and bought it for a "fabulous" price to add to a collection of scientific objects he was gathering for exhibition purposes. After paying heavy duty charges to get the moon model into the United States, Riverton spent thousands on advertisements and preparations for exhibition in New York. Unfortunately, "the cold, bare surface of the moon did not attract the general public" and the project was a financial disaster. Riverton tried his scheme in other cities, too, but found no success anywhere.

The model and the rest of Riverton's collection of scientific objects were finally resigned to storage in a Chicago warehouse where Riverton's luck went from bad to worse. The warehouse caught on fire and most of the collection was destroyed—uninsured. The moon model was saved, however, and passed into the hands of Lewis Reese in payment of a loan he had advanced to defray storage charges.

Reese, a manufacturer of astronomical telescope lenses, was initially pleased with his acquisition but after keeping it in storage himself at 1435 State Street for ten years, decided it was a liability and offered it to the Field Museum as a gift.

After assuring themselves of the scientific accuracy and fine quality of the model, Director Skiff and Chief Curator of Geology Farrington accepted Reese's offer and the dismantled model was transported to the Museum.

The model, made of 116 sections of plaster on a framework of wood and metal, had been constructed under the direction of Dr. J. F. Julius Schmidt and was modeled by Thomas Dickert, curator of the museum at the University of Bonn. Hailed by scientific experts across Europe as a marvel of accuracy and detail, the moon model soon found an appreciative audience at the Museum.

When the Museum first placed the model on exhibit it offered a fascinating look at the then little known planet. Today, on display in Hall 35, the model may be used to select a possible future vacation site. ■

INCA TOUR *(continued from page 4)*

The islands are all close enough to each other that the same or similar wildlife arrived at each. Yet they are far enough apart that once landed, the new inhabitants found it difficult to move from one island to the next. As a result, the specific geological and plant life conditions of each island helped determine the evolutionary characteristics of the wildlife of that island.

You are accompanied during the eight-day cruise by a zoologist from the Universidad Catolica in Quito with experience on the Galapogos. You are also greeted and hear lectures by representatives of the Darwin Station.

The cruise ship takes you to all the major islands and points of interest—Baltra, the Plaza Islands, Hood Island, Charles Island, Point Cormorant, Post Office Bay, Black Beach, Indefatigable Island, Academy Bay (where the Darwin Station is located), James Island, Sullivan Bay, Bartolome Island. Narborough Island, Point Espinoza, Albemarle Island, Tagus Cove, Tower Island, Darwin Bay, and back to Baltra.

You fly from Baltra to Guayaquil and Guayaquil to Miami and Chicago. ■

Places Remain on BRITAIN TOUR

There are still places open on Field Museum's natural history tour, "Eden Revisited: A Tour of Britain and Its Gardens," May 30–July 4, which stresses stately homes and gardens of England, Wales and Scotland, but also highlights bird walks, wild flower stops and archaeological sites.

The tour, priced at $2,445, including $600 tax-deductible donation to Field Museum, covering all expenses but tips, will be led by Phil Clark, Museum Tours Chief. He is now leading tours of India and Nepal, and is former Editor of *Horticulture* magazine. British garden specialists will join the tour at various places. It is limited to 25 persons. Reservations may be made by phoning or writing, Field Museum Natural History Tours.

CLIP AND MAIL THIS COUPON TODAY

I would like reservations for Field Museum's Natural History Tour of Bogota, Peru, Bolivia, Ecuador and the Galapagos, "The Inca's Empire and Darwin's Galapagos" as follows:

30-day tour—December 31 – January 29, 1971 ☐
February 4 – March 5, 1971 ☐

22-day tour—Without Galapagos
December 31 – January 21, 1971 ☐
February 4 – February 25, 1971 ☐

I understand the $2,807 price of the 30-day tour and cruise and the $2,457 price of the 22-day tour (without the Galapagos) cover all expenses (except tips) and include a $600 tax-deductible donation to Field Museum.

I enclose my check for a $600 deposit for each reservation.

Name .....

Address .....

City ..... State ..... Zip .....

☐ Please check if single rooms are desired, at an extra charge.

Please send information about this tour to:

Name .....

Address .....

City ..... State ..... Zip .....

San Francisco Church in La Paz, Bolivia, bears handsomely-carved doorway lintels and columns.

The Edward E. Ayer Spring Film-Lecture Series

Field Museum's 132nd series of free illustrated lectures offers exciting filmed adventure in color ranging from the inspirational monuments of Washington, D. C., to the majestic heights of the Kulu Himalaya mountain range. The program begins at 2:30 p.m. on Saturday, March 7 in James Simpson Theatre and continues on successive Saturdays through April 25. Seats will be reserved for Members until 2:25 p.m. Attendance is limited to adults and children of Members.

March 7 WINGS TO WASHINGTON
By James Metcalf

Famous historic monuments and the busy everyday life of our nation's capital contrast with scenes of exotic water lilies grown from 3,000-year-old seeds.

March 14 MINNESOTA SAND COUNTRY
By Walter J. Breckenridge

Sand-dwelling birds, mammals and reptiles highlight this ecological review of a sand dune region that typifies similar areas found in the Northcentral States.

March 21 COASTAL CALIFORNIA
By Albert J. Wool

A sea otter cracking abalone on his anvil is one of the many outdoor wonders of Northern California captured in this informative color film.

March 28 CANADA'S MOUNTAIN WILDERNESS
By Edgar T. Jones

This exciting film spanning the seasons features a rare sequence of the *Rugous* hummingbird, as well as the rich animal and plant life of the region.

From "Fiji, Western Samoa and Tonga" film, April 18

From "Houseboat to Florida" film, April 4.

April 4 HOUSEBOAT TO FLORIDA
By Howard Pollard

This cruise along the Atlantic coast in a houseboat reviews much of America's early history and shows the variety of wildlife seen along the Inland Waterway.

April 11 ALASKAN SUMMER
By Mildred Capron

The spirit of the Yukon and the wild and magnificent beauty of Alaska are vividly portrayed in this imaginative color movie.

April 18 FIJI, WESTERN SAMOA AND TONGA
By Nicol Smith

From enchanting mountain pools to a famed 300-year-old turtle, life in these remote islands of the Pacific is depicted with keen observation by this noted lecturer.

April 25 MUKAR BEH
By Dennis Gray

Life in India today, customs of local hillsmen and travel in North India are part of this exciting story of the ascent of the formidable peak of Mukar Beh.

Children's Workshops Planned for March

Application forms are now available from Field Museum's Department of Education for two four-part Saturday workshops for children. Each begins on March 7 and continues on consecutive Saturdays through the month, March 14, 21, and 28.

Mask-making and fun with patterns in nature are part of "Art in Nature," a four-session course for youngsters in the third, fourth, and fifth grades. The workshop will be conducted by Mrs. Elizabeth Goldring, Raymond Foundation lecturer.

"Earth and Space," led by Ernest Roscoe, lecturer in geology, is the other four-session course being offered. This program, for sixth, seventh, and eighth graders, includes an explanation of rocks, minerals, space geology, geology of the Chicago region, and fossils.

Each series is being offered to children of Museum Members for a fee of $10.00. The cost for children of non-Members is $15.00. Payment is due upon confirmation of enrollment by the Museum.

Because classes will be limited to 25 youngsters, Members are urged to write for application forms early. Completed application forms must be in the Field Museum no later than February 20. Enrollment is on a first-come, first-served basis. Each series is open only to those grades specified.

For application forms, write to:

Department of Education
Field Museum of Natural History
Roosevelt Road at Lake Shore Drive
Chicago, Illinois 60605

Dr. Fritz Haas, Former Curator Dies

With the death on December 26, 1969 of Fritz Haas, Curator Emeritus of Lower Invertebrates, Field Museum lost one of its most famous and productive scientists. An account of his career and the celebration for his 60th year as a publishing scientist appeared in the *Bulletin*[1] two years ago. Since then two major publications of his have been issued—a 663-page monograph in the German serial "Das Tierreich" covering the species of fresh-water unionid clams and a 60-page review of the fresh-water clam genera in the "Treatise on Invertebrate Paleontology."

From 1911 to mid-1936, Fritz Haas was a research zoologist at the Natur-Museum Senckenberg, Frankfurt, Germany where he could work with exceptionally comprehensive library and collection facilities. Because of his Jewish faith, he and his family had to leave Germany. On August 1, 1938 he began a second career as Curator of Lower Invertebrates at Field Museum, where he was faced with the task of building both library and collections. That he succeeded so well and still remained productive in research is a tribute to his persistence and capacity for work. For eight years after normal retirement age he continued at Field Museum as full-time Curator. Even after becoming Curator Emeritus in January 1959, another six productive years were spent in daily work on the collections and writing manuscripts.

A gentle and quiet man of learning with a warm sense of humor, Fritz will be greatly missed. A generation of scientists and librarians depended on his knowledge of the humanities and several languages for aid with obscure quotations or the translation of difficult passages. Few geographic localities could puzzle him, no matter how fragmentary, and one of his last contributions to Field Museum was in aiding our entomologists to interpret cryptically abbreviated localities scrawled in germanic script on tiny insect labels.

Men are rightly judged by their legacy to mankind. Fritz Haas left an impressive addition to human knowledge in the form of over 300 scientific articles, a newly developed research facility of library and collections at Field Museum, a son who is a Professor of Political Science at the University of California, Berkeley, a daughter with extensive musical training, several grandchildren, and many lives that were enriched through knowing him.

Alan Solem,
Curator of Lower Invertebrates

[1]Vol. 38, number 11, November, 1967.

CALENDAR OF EVENTS

February hours: 9 a.m. to 4 p.m., Monday through Friday; to 5 p.m. Saturday and Sunday. On February 12, Lincoln's Birthday, the Museum will be open to 5 p.m.

Through February 22 Twenty-Fifth Chicago International Exhibition of Photography, sponsored by the Nature Camera Club of Chicago and Field Museum, features award-winning photographic prints in the Museum's South Lounge. Prize-winning transparencies will be shown at 2:30 p.m., February 1 and 8 in James Simpson Theatre. The exhibition and slide presentations are free to the public.

Through February 28 Winter Journey "It's a Rocky World." Free self-guided tour teaches boys and girls the intrinsic and practical value of rocks. It acquaints youngsters with the main types of earth rocks, their classification, and the processes by which they were formed. Any child who can read and write may participate. Award certificates are given to successful participants each spring.

Through March 1 Eskimo Masks: The World of the Tareumiut, a temporary exhibit of expressive carved wooden masks produced by the aboriginal people of Point Hope, Alaska. Shown free in Hall 9 Gallery, the exhibit presents Field Museum's collection of masks acquired during the turn of the century and related ethnographic material. It also includes masks on loan from the Sheldon Jackson Museum of Sitka, Alaska.

Continuing Field Museum's 75th Anniversary Exhibit: A Sense of Wonder, A Sense of History, A Sense of Discovery. This trend-setting exhibit shows the scope of the Museum's activities since its founding and features unusual and exciting means of visual communication. Hall 3.

MEETINGS:

Chicago Shell Club, February 8, 2 p.m.
Nature Camera Club of Chicago, February 10, 7:45 p.m.
Illinois Orchid Society, February 15, 2 p.m.
Friends of Our Native Landscape, February 22, 2 p.m.

FIELD MUSEUM
OF NATURAL HISTORY
ROOSEVELT ROAD AT LAKE SHORE DRIVE
CHICAGO, ILLINOIS 60605 A.C. 312, 922-9410
FOUNDED BY MARSHALL FIELD, 1893
E. Leland Webber, Director

BULLETIN **FIELD MUSEUM OF NATURAL HISTORY**
Volume 41, Number 3 March 1970

WHITE HOUSE COMES TO FIELD MUSEUM

Seated around a conference table in Museum President McDowell's office, President Nixon, eight cabinet members, Illinois Senator Charles Percy and four governors begin discussion of the nation's air and water pollution problems.

Presidential Visit to Field Museum

by Patricia M. Williams

PRESIDENT RICHARD M. NIXON came to Field Museum of Natural History on February 6, 1970 to attend the Great Lakes Regional Environmental Quality Conference — a cabinet-level meeting on pollution. This marked the first time such a meeting was held outside of Washington, D. C. and included, in addition to the President and the Cabinet Committee on the Environment, Gov. Whitcomb of Indiana, Gov. Milliken of Michigan, Gov. Knowles of Wisconsin, and Gov. Ogilvie of Illinois. This unprecedented action is only a part of President Nixon's full-scale assault on environmental degradation in America.

In his State of the Union message, President Nixon said, "The great question of the '70's is: Shall we surrender to our surroundings or shall we make our peace with nature and begin to make reparations for the damage we have done to our air, to our land and to our water?" On New Year's Day, in his effort to make "peace with nature," the President signed the National Environmental Policy Act as his "first official act in this new decade."

Of the new act, Nixon said, "The act I have signed gives us an adequate organization and a good statement of direction. We are determined that the decade of the seventies will be shown as the time when this country regained a productive harmony between man and nature."

This act not only made protection of America's natural resources a national policy, it established a three-man Council on Environmental Quality as well. This council, like the Council of Economic Advisors, will have a "close advisory relation" to the President and will review all federal activities that affect the quality of life in the United States. Russell E. Train was named as Chairman of the new council and his fellow members are Gordon J. F. MacDonald and Robert Cahn.

Separate from this three man council, the Cabinet Committee on Environmental Quality is chaired by President Nixon himself. Emphasizing the significance of his role as chairman of this committee Nixon stated, "the 1970's absolutely must be the

years when America pays its debt to the past by reclaiming the purity of its air, its water, and our living environment. It is literally now or never."

The meeting at Field Museum combined both the Cabinet Committee and the new council. The four governors presented the environmental control programs that they have instituted in their states and all four governors united in a request to the federal government to reconvene the Lake Michigan Enforcement Conference to review existing anti-pollution compliance deadlines and require major polluters to show evidence that they will meet the deadlines. Following the meeting President Nixon said, "I believe that it can be said that these four states have programs that are in the forefront among the states of this nation in the environment."

The pollution of Lake Michigan is a problem common to all four participating governors and it received particular attention. To avoid the death of Lake Michigan, President Nixon called for "total mobilization." "Only through total mobilization can we deal with the problem of water pollution, air pollution, and the other problems that affect our environment." He went on to promise that "we are going to close the action gap. We are going to authorize funds but we are also going to appropriate funds. We are not going to make promises for action and not keep those promises." According to the President, $2½ million for Ft. Sheridan and $12½ million for the Great Lakes Naval Training Station "will stop pollution of these facilities and it will accomplish it before the end of 1972."

After the President made a brief statement to the press, the four governors held a joint press conference. Gov. Ogilvie then followed with his own conference in the Museum's Lecture Hall.

It was, all told, an eventful and important day in the history of the Museum; a day that focused the nation's attention on the Museum and its concern for the problems of man's total environment. As Remick McDowell, President of Field Museum, said, "What better place to hold such an important meeting than at an institution concerned with the study of man's environment. Field Museum's departments of anthropology, botany, geology and zoology have a long tradition of concern and involvement in environmental changes. The Museum's area of interest embraces all life on earth, past and present, human and non-human. This is reflected not only in the Museum's exhibits but also in the work conducted in the community by our scientists."

The President's visit and the events surrounding it are reported and pictured in the pages that follow. It is hoped that the interest this visit generated in the environmental problem will not only be sustained, but will grow and swell as increasing numbers of private individuals become actively concerned. To this end, Field Museum will not only continue its on-going program of research and education, but will also launch a series of exhibits dealing with the environmental crisis.

In his press conference Gov. Ogilvie said, "We have met the enemy and it is us." If peace is to be made with nature, the enemy must be informed and reformed; involved and concerned. As the nation is intensifying its efforts toward a healthier environment, let this day mark your increased involvement with the problem as well. ■

The Field Museum's participation in the Great Lakes Regional Environmental Quality Conference is a truly significant event in the Museum's long history of concern for the problems and needs of man's total environment. Our on-going program of research, education and exhibition takes on even greater importance at this critical time.

E. Leland Webber
Director,
Field Museum of Naturol History

THE WELCOMING OF THE PRESIDENT

by Patricia M. Delsing

Remick McDawell greets some early arrivals.

THERE is an old saying that coming events cast their shadows before them. This is especially true of an appearance by the President of the United States. On Friday, February 6, President Nixon was to arrive at Field Museum at mid-morning. But hours earlier, before the winter sun fought its way through Chicago's damp haze, the Museum doors were revolving non-stop. Outside, on the steps, groups of men shivered in their heavy coats. Some wore badges identifying them as members of the Official Welcoming Committee; they wanted to see and be seen. Others bore discreet lapel pins marking them as secret service agents or Chicago policemen; they scrutinized people coming up the steps and coolly surveyed the general area. Museum personnel with top security clearances also would receive distinctive lapel pins so they could move freely through areas that would be off-limits to the public.

Inside, a platoon of security forces reviewed their instructions one last time before moving to their posts; individual communications units welded them into a solid force of protection. Uniformly pleasant men, polite

Museum president Remick McDawell, center, welcomes President Nixon and Illinois governor Richard B. Ogilvie, left.

Trailed by officials, aides and security men, President Nixon moves through welcoming crowds.

and well-dressed, their singular responsibility showed in their alert manner and ever-searching eyes.

Shortly after 9 a.m., ticketed visitors began crowding through the doors and selecting vantage points along the railings which sectioned the main hall. The Museum had been closed to the general public for the day, but school groups that previously had arranged for lectures were invited to come for the sessions plus a bonus—a view of the President.

With the arrival of each new group, the sound of excited chatter exponded in Stanley Field Hall. Some youngsters held signs asking for an end to pollution. One contingent carefully-carried an elaborate banner welcoming the President.

White House aides listened to their communications units to follow the itinerory os the President and his porty moved through early morning appearances north of Chicago. A Presidential staff member reviewed procedures one last time with Museum President Remick McDowell who was to welcome Mr. Nixon at the door and escort him to the meeting room. ➤

This group's imaginative banner drew an enthusiastic "thank you" from President Nixon.

Behind the scenes activity increased. Even top-cleared persons were politely ushered from rooms to be occupied by the President so the areas could undergo a final search.

At the announced arrival time of 10:20 a.m., hundreds of men, women and children stared toward the south door of Stanley Field Hall. Voices rose as new groups appeared in the doorway and fell when the newcomers proved to be other spectators.

Finally, nearly a half-hour late, secret service men received the report they had been waiting for. Minutes later, a crowd of people surged through the door in what appeared to be a single advancing organism. Photographers and TV cameramen led the pack, security men ringed it, and in the middle was a tanned, smiling man who waved energetically at the cheering and yelling and waving crowd.

Escorted by Remick McDowell, President Nixon moved into the hall to greet some children lucky enough to be near the door. Newsmen, reporters and on-lookers struggled for a picture, a statement, or just a glimpse while secret service men closed in to wall him off. As he moved, the incredible power of his office went with him; everyone in the hall felt it.

Happiness is shaking hands with the President!

A few moments there and he disappeared into the President's Office where his famous companions already had entered unnoticed. Highly-motivated, intelligent and successful men, they had become suddenly anonymous. When the President is there, all others are

After the conference, President Nixon pauses in Stanley Field Hall for a chat with same young citizens.

added attractions, even governors and Cabinet members and experts in their own fields.

Before the meeting began, photographers were permitted to push into the room to record the scene. While they moved around urgently adjusting shutters and lenses, the conferees talked quietly—a group of confident, businesslike men sitting at a simple table. But the power was there, too, and its presence hung stalactite-fashion in the room.

For more than two hours the meeting went on while the Museum went about its interrupted routine. Classes for school children got under way. Visitors strolled through the exhibit halls.

Reporters in the James Simpson Theatre picked up rolls and coffee from a table in the lobby and releases from a table on the stage where a White House press office smoothly went into action.

Business spurted in the Museum Bookshop as members of the press caravan sought out souvenirs. Old-hand White House reporters filed their stories and looked blasé while everyone else looked impressed by the prominent "White House Press" credential badges. Photographers shifted their cameras from hand to hand and compared equipment with their colleagues. ➤

Reporters hastily write and file their stories from the communications complex in James Simpson Theatre.

TV cameramen record the press briefing.

At the post-meeting press conference, Mr. Nixon outlines his proposals to curb water pollution.

The Museum switchboard operator took messages from famous names and had them delivered to other famous names and wondered what page-one news stories were evolving.

And suddenly, the tempo increased again. Groups of children who had waited patiently throughout the meeting were rewarded with an invitation to move toward the center of Stanley Field Hall where the President was to walk. And then he was striding through the hall, smiling and shaking eager, outstretched hands while aides distributed pre-signed autographs. He stopped, propped a foot up on the side of a fountain, and launched into a man-to-man conversation with some small boys. A welcoming song by a group of teenage girls brought a smile and a wave. And behind him trailed the ubiquitous secret service agents and the governors and the Cabinet members and the experts on environment who had followed him all day.

Then they were out of sight, dashing down the steps to the lecture room for a brief press conference. But he would be back; sandwiches from the buffet were shuttled on plates into the Museum's public relations offices to fuel a short private meeting. While he huddled in the office with his guests, other conference participants remained downstairs to take their turns before the television cameras so their constituents back home or their Washington staffs could see them on the evening news.

When the President emerged from his private meeting, the crowd in Stanley Hall had dispersed. Familiar faces, finished with their statements and their sandwiches, wandered ahead of him toward the door, stopping occasionally to greet Museum personnel. He

stopped to shake hands, too, and to recall a visit to the Field Museum with his wife while on leave from his World War II assignment.

And he was suddenly not the President with the coreful crowd smile, but a soft-spoken, rather intense man remembering a simpler time when he and his wife could enjoy a quiet day in a museum. But the time to chat was short and the secret service men were restive so he moved on, smiling a wistful but friendly good-bye over his shoulder.

One more stop near the door for a Museum employe to return papers forgotten in the conference room. And he was gone. An aide briefly reappeared with a handwritten thank you note for the papers, and he was gone, too.

Late afternoon Friday. The Museum staff reluctantly began dismantling the crowd barriers, rearranging their offices and restoring the building to its normal appearance. But it would never be the same. Because the President of the United States had been there. And they would never be the same. Because they had been there with him. ■

For Illinois television viewers, a Chicago newsman interviews Governor Ogilvie.

AS HE WAS LEAVING, the President paused under the elephants and gave us one of the most memorable quotes of the day. In answer to the comment, "I hope you enjoyed your stay here," President Nixon replied, *"I did, very much. You know, I was here years ago. I was stationed at the naval base at Ottumwa, Iowa and my wife and I took the Burlington Zephyr to Chicago and stayed at the Palmer House. It was a very nice room too. We came to the Museum and wandered all through here . . . That was 30 years ago you know . . . But we used to be great museum goers . . . we went to the Smithsonian and to the museum in Los Angeles."* Somewhat wistfully he ended, *"It was a little easier to do things like that then."*

THE DAY

Museum maintenance men work around Thursday visitors.

While preparations for the President's visit speed along in other parts of the Museum, lecturer Ernest Roscoe conducts a classroom discussion about geology.

"LINE UP in twos, children, and stay together when we walk upstairs." A teacher efficiently swept her wide-eyed fifth graders through the main hall of the Field Museum and up to a classroom where a Museum lecturer prepared to introduce them to the marvels of the earth's composition.

Adults strolled leisurely through the Museum's treasure-filled halls and behind the scenes, in laboratories and libraries, continuing research projects quietly moved on.

It was Thursday, February 5, and it appeared to be a routine day at the Field Museum. But it wasn't. It was the day before a visit by the President of the United States. And quietly and smoothly, with the precision given to planning a Medieval Royal Progress, the staff and resources of the Museum were being marshalled to contribute to the success of the occasion.

If they had read of the event, Thursday's Museum-goers might have sensed the current of excitement running through the Museum which would reach flood stage as the day wore on. They might have realized that the huge table with its matching chairs being moved into the "President's Office" at the south end of the building was to be used by THE President as the focal point of a meeting on Great Lakes Regional Environment — the first Cabinet-level meeting outside Washington, the first meeting of the new Presidential Council on Environmental Quality, and the

BEFORE

by Patricia M. Delsing

A giont conference table, borrowed from a Chicago insurance company for the meeting, is assembled in the President's office.

first such meeting held in a museum.

On-lookers could have observed Building Superintendent James Shouba checking off completed jobs from a lengthy list which grew longer minute by minute. Maintenance crews carefully sponged nearly-invisible smudges from the ivory walls, washed and rewashed the floors, and even checked the water level in the newly-cleaned fountains so they would splash majestically on cue. Auxiliary pots of greenery appeared in the main hall to supplement standard decorations.

At each end of Stanley Field Hall, electricians wired yard-long boards with dozens of plugs for cameras and lights which would record the next day's activities.

There were other unusual sights to be seen that day. More electrical outlets and a two-level platform for TV cameras in the lecture hall adjoining the James Simpson Theatre. Newly-installed carpeting on the stage of the hall. Hastily-hung draperies behind the stage to backdrop the post-meeting news conference at which the President, four governors and a galaxy of Cabinet members would tell the public how they planned to curb the pollution of the Great Lakes. Ten public telephones had been mounted on plywood boards in the Simpson Theatre, and double that number of long distance phones connected to news outlets throughout the country.

At several points in the building, shiny new wires activated ordinary-looking ➤

Matching chairs are rolled in next.

Electricians wire supplementary power sources for TV lights and cameras.

Presidental visit photos by:

John Bayalis
Homer V. Holdren
Frederick Huysmans
James J. Jindra
Harry S. Young

telephones which bore a picture of a familiar structure and the words "White House" where the number appears on truly ordinary phones. The instruments were connected to the traveling White House switchboard housed temporarily at the President's Chicago hotel.

In their offices, five Museum curators prepared statements regarding the environment-related activities of the Museum for press distribution Friday.

By late Thursday afternoon, the President's Office was ready. Cold sunlight streamed through sparkling windows which would be shielded on Friday by the heavy blue draperies. The flags of Illinois, Indiana, Michigan and Wisconsin, as well as the American flag, flanked an easeled, Interior-Department-prepared map of the Great Lakes region. Miniature state flags stood at seats assigned the state's governors at the table. One place, simply marked "President," was heralded by the stars and stripes.

As the room's name indicated, portraits of former Field Museum presidents looked down from the office walls; some of the likenesses had been retrieved from the continuing 75th anniversary exhibit at the opposite end of the building and returned to their rightful places to observe the meeting.

The Museum's own antique furniture and art objects from around the world contrasted pleasantly with the businesslike efficiency of the borrowed conference grouping.

Late Thursday afternoon, Remick McDowell, Museum president, looks over the conference room after a briefing by White House aides.

The silent White House telephone is ready for use by the Museum's famous visitor.

Beautifully assembled under the regal chandelier, the table received a last glossing; around the table, chairs were polished and positioned. Freshly-sharpened pencils and yellow legal pads favored by the meeting's leader were distributed. In the outer office, coat racks were moved in; half the room was screened off for a private ante-room; flowers were arranged.

Finally, posts and barriers to contour crowds were moved in and set up on the first floor. One hall was screened off and prepared for a select buffet luncheon to be served on Friday. Information booths were moved to the north end of Stanley Field Hall, topped with plywood and quickly painted; on Friday they would serve as platforms to raise photographers above the crowds.

As most Museum staff members departed for the day, mentally reviewing their up-coming assignments, they left behind Museum guards, secret service men and Chicago policemen. Musuem Chief of Security August Teschendorf had met with officers of other security forces to coordinate operations for the event. During the week, literally every inch of the multi-acre building had been searched, inside, outside, around and above, time and time again, guided by Len Carrion, Chief Engineer. Thursday night, security men would patrol the echoing halls again, linked by their communications equipment, inspecting every possible point of access or concealment.

Thursday, February 5, was a day like any other at Field Museum. Almost. ■

* FIELD MUSEUM CURATORS SPEAK OUT

To Field Museum's 32-member scientific staff, preservation of natural resources is not a new area of interest.

Historically, Field Museum has been closely concerned with man and his environment for more than 75 years—long before conservation and pollution became household words.

The long-range commitment put into motion by President Nixon's visit must be met if man is to live in harmony with nature. Field Museum's involvement will increase as time goes on with its continuing programs of research, education and exhibition.

The following statements are made by members of Field Museum's curatorial staff in connection with the February 6 conference.

Dr. DONALD COLLIER
Chief Curator of Anthropology:

"Mon has been interacting with his environment for over two million years but only during the past 150 years has he been seriously out of balance with nature. The long view of natural history and the immense perspective of paleoanthropology are essential in the present world crisis—the pollution and degradotion of the earth's environment.

Students of notural history welcome the present surge of public concern with our environment but hope that action will extend beyond ameliorating the most spectacular pollution of oir and water. The hidden effects of pollution are more deadly and more long-lasting, including genetic domoge to oll living things. Three-quarters of the world's surface is ocean, but most of us are little aware of this major element in earth's environment or the seriousness of marine pollution. At present a million tons of oil ore being dumped into the ocean annually. The effects of this, insecticides, and other serious pollution—everything dumped into streams, lakes and rivers ends up in the oceon—may be irreversible or reversible only in terms of a thousand year period.

Naturol history museums have the resources to present to the public the long view, the basic view, the holistic view of man and nature, and now is the time to do it. We hope the Field Museum will be in the forefront of this effort."

Dr. LOUIS O. WILLIAMS
Chief Curator of Botany:

"The botanists of Field Museum have been especially interested in the vegetation of Central America ond the Andean countries of South America. This interest extends back more than 75 years. The problems of the relationships of man to the plant cover in these regions have been and are of active concern to the botanists here. What happens ond is happening to the vegetation of this region seriously affects the food chain that reaches to man. Degradation of the vegetation and consequently of the environment is proceeding at an explosive rate in Central and Andean South America—regions where Museum botonists hove considerable competence."

Dr. AUSTIN L. RAND
Chief Curator of Zoology:

"If you stand on Field Museum's front steps and look at the city, you may wonder what is was like before concrete, steel and civilization came to the foot of Lake Michigan. If you do wonder, step back into the Museum exhibit halls and see.

This is one of the contributions that Field Museum is making to present day Chicago and the nation: showing the actual animals that live or did live in our country, some of which are gone beyond recall. Here also are the animals which we can continue to have and enjoy. But, only if we change our emphasis from trying to conquer nature to trying to live with nature, will we then have a fuller life."

Dr. RAINER ZANGERL
Chief Curator of Geology:

"Today, pollution of air, water and land has reached global proportions and has already seriously affected the ecological check and balance system that governs life on our planet. The rapidly deteriorating quality of the environment has received a great deal of attention in the popular press and there is, indeed, good reason for public concern.

Intelligent action on the part of the public, however, requires understanding of the complex problems. With this in mind, Field Museum is planning a series of exhibits designed to provide the scientific background and the historic perspective to the headlines, committee reports and remedial programs that publicize the present environmental crisis."

Dr. RUPERT L. WENZEL
Curator of Insects:

"This important conference underscores the urgency of coping with problems of pollution and alteration of the environment. It is appropriate that it was held in Field Museum. First, because it is located on the edge of Lake Michigan, and the pollution of this great lake is one of the chief concerns of the meeting. But also because of the role of natural history museums. Field Museum's research and educational goals are largely concerned with discovering and making known the things which comprise our environment and the historic processes by which they came about, as well as the ways in which man has adapted to, used and altered the environment. These are things which man must understand if he is to learn to live with nature, without further damaging or even destroying both his environment and himself.

Because of their special knowledge and concern with environmental problems, many of the Museum's scientific staff have been directly involved, as individuals, in conservation, pesticide abatement and other aspects of environmental control and improvement. Some have done this individually, or through local action groups or their national professional organizations, while others have helped determine policy and action as elected or appointed officials of municipalities, abatement districts, and State conservation bodies."

Members of Field Museum's scientific staff. Shown from left to right are Dr. Austin L. Rand, Dr. Donald Collier, Dr. Louis O. Williams, Dr. Rupert L. Wenzel and Dr. Rainer Zangerl.

HEARD UNDER THE ELEPHANTS

by Patricia M. Williams

After stringent security screening, a few Museum staff members were permitted to meet and talk with President Nixon and members of the Great Lakes Regional Environmental Quality Conference. Following are some of the questions, answers and observations recorded from these conversations.

WHAT CAN A CONCERNED INDIVIDUAL DO TO HELP IN THE FIGHT AGAINST POLLUTION?

RICHARD B. OGILVIE
Governor of Illinois

"I think the public has to put their money where their mouth is. It's going to be an expensive proposition."

CHARLES H. PERCY
U.S. Senator

"If he is married, have only two children."

GEORGE ROMNEY
Secretary of Housing and Urban Development

"An individual can do a great many things — stop littering, first. Stop throwing papers and refuse from cars, stop littering up the streets. Clean up his own neighborhood and encourage his friends and neighbors to do the same. Also, an individual can support the legislation that is needed to preserve the environment. An individual can also encourage automobile legislation as the automobile is one of the chief sources of pollution."

JOHN VOLPE
Secretary of Transportation

"The public must be awakened. Most people are not aware at this time of the scope of this problem. We hope that the people will join in voluntary efforts and voluntary action committees to support programs and legislations designed to fight pollution.

I would hope that the young people on campuses all over the country would work affirmatively and devote their energy to supporting programs and once these programs are passed, work to see that they are carried out.

As Governor of Massachusetts, I learned that legislation is much easier to pass if public support is behind it and that will be true of programs concerning our environment too."

RUSSELL E. TRAIN
Under Secretary of the Interior and Chairman of the Council on Environmental Quality

"An individual can do much more than just stop littering and cleaning up his property. Parents can see that the curriculum in schools includes the environment. They can work through adult education programs and such groups as the League of Women Voters to educate the public to the problem. An individual can also help to control the birth rate."

WHAT ROLE DO YOU THINK A NATURAL HISTORY MUSEUM CAN PLAY IN THE EFFORT FOR A CLEANER ENVIRONMENT?

SECRETARY VOLPE

"No question about natural history museums providing leadership in educating the public."

GOVERNOR OGILVIE

"This Museum has already performed an important role in providing a place to hold this meeting. The museum can help in educating the public through exhibits and programs."

by Donald C. Edinger
Chairman, Department of Education

The objects and specimens on exhibit here in the Museum represent a rich statement about our environment. The students viewing these objects find that the world itself is our environment rather than a small segment of Illinois. Nearly 80% of the offerings of the Department of Education are directly related to the study of the environment.

From key questions and statements a student can make a series of observations which will help him begin to describe our world. This description not only includes a stop motion for one point in time but several different points in time — often in the same geographic area.

In helping students identify some of the variables affecting the world and its inhabitants, they can begin to predict the consequences of change.

The skills of studying the environment through natural history are taught in each tour conducted by the staff, both volunteer and professional. These skills include observing, classifying, describing, space/time, inferring and predicting. In the development of these skills and attitudes as intellectual tools, a basis is provided for further study. Each of us feels a great responsibility and a sense of dedication toward teaching a respect for living things, the importance of cause and effect relationships, and most of all, what each individual can do to contribute toward creating the best possible circumstances for all living things.

How other cultures compromised with their environment and what the apparent consequences were, can be observed by the students. The strong inference that time is an increasingly important variable is supported by observations both within and without the Museum.

We hope to stimulate interest and broaden the base of general knowledge. With the cooperation of teachers we feel that a unique experience is provided for school groups that cannot be duplicated in any other way. ■

ELLEN THORNE SMITH
ELECTED TRUSTEE

Ellen Thorne Smith (Mrs. Hermon Dunlap Smith) has been elected a Trustee of the Field Museum of Natural History. A By-law amendment providing for the election of the president of the Women's Board as a Museum Trustee with voting privileges was recently adopted by Field Museum's Board of Trustees. Mrs. Smith, the incumbent Women's Board President, was elected at the same meeting.

Mrs. Smith has been associated with the Field Museum for more than 30 years as a volunteer in the Division of Birds, Department of Zoology. In 1937, she was named an Associate in the Division of Birds. During World War II, when many of the Museum's scientists were serving in the armed forces, Mrs. Smith kept the division open.

In 1966, at the suggestion of the President of the Board of Trustees and the Director of the Field Museum, Mrs. Smith organized the Women's Board. She has served as its President since that date.

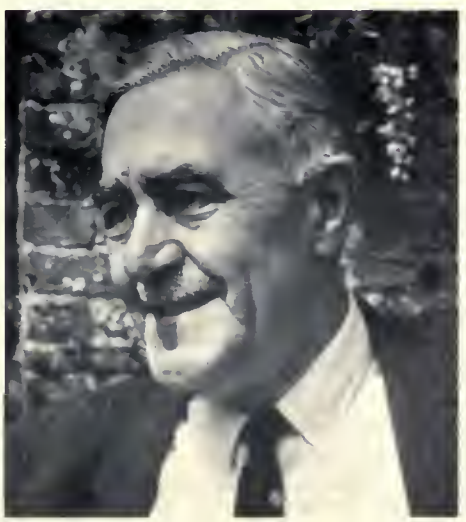
Mrs. Smith is the author of *Chicagoland Birds—Where and When To Find Them*, a handy pocket guide for birdwatchers. She serves as a Trustee of the Chicago Zoological Society and the Hull House Association. For 19 years Mrs. Smith was the editor of the Brookfield Zoo magazine.

The well-known British gardening expert, Mr. Roy Hay, garden editor of the London Times and BBC, and author of numerous horticultural books, will speak on British gardening to members of Field Museum at 3 p.m. Sunday, March 22nd, in the Museum's lecture hall.

This is an opportunity to hear a talk by a man who has been called "the World's No. 1 Gardener." Included will be a showing of a color motion picture of outstanding British gardens. Mr. Hay will answer questions afterwards.

To those people taking Field Museum's tour, "Eden Revisited: A Tour of Britain and Its Gardens," it will be an opportunity to meet Mr. Hay first-hand. Tour members will spend an afternoon as guests at his 16th Century house and visit his interesting experimental gardens next June.

The 36-day tour, May 30 - July 4, 1970, will visit outstanding gardens, wild flower spots, bird sanctuaries, and archaeological sites in England, Wales and Scotland. Including a tax-deductible $600 donation to Field Museum, the cost is $2,445, covering all expenses except tips. At this date a few places remain open. Information may be obtained by writing Field Museum.



ROY HAY
GUEST LECTURER

Spring Journey

INDOOR PROGRAMS BRING OUTDOOR PLEASURES

Trees of Illinois is the title of Raymond Foundation's Spring Journey. Available for boys and girls from March 1 until May 31, the Journey features a variety of Illinois trees, including both introduced and native species.

Illinois extends nearly 400 miles from north to south and lies almost at the center of the North American continent. This location makes it a transitional region where trees predominant elsewhere in the United States may be found.

For example, the white pine, a tree characteristic of northern forests, is found in Illinois, as is the bald cypress which is found in southern forests. Such a combination is not surprising when one considers that the southern tip of Illinois is farther south than Richmond, Virginia. Also found in Illinois are the black locust and osage orange, trees which are common to other parts of the United States.

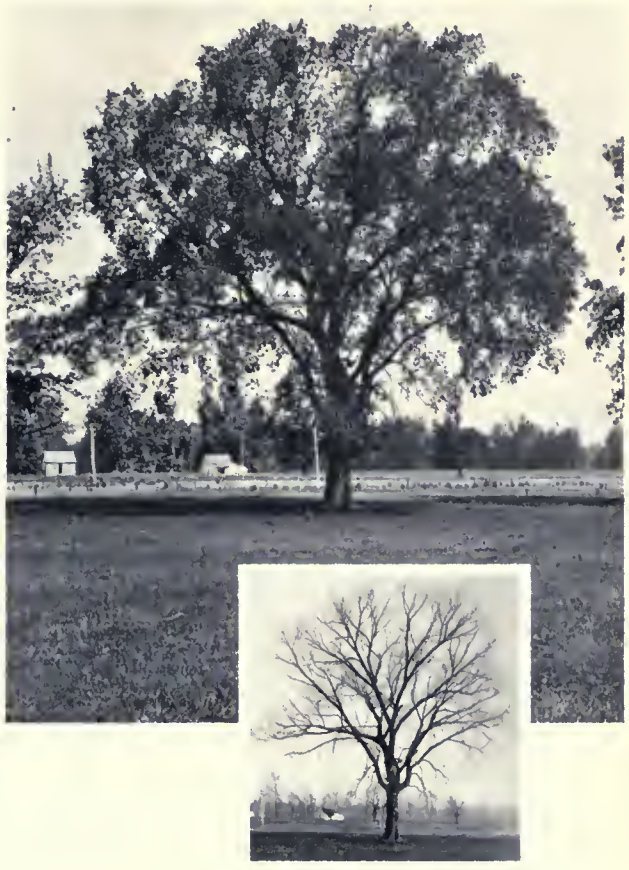
The Gingko and horse chestnut, trees introduced into the United States from foreign countries, thrive in Illinois. They are sometimes planted along city streets because of their beauty and hardy qualities.

Native Illinois trees featured in the Journey are basswood, white oak, American elm, sycamore, bur oak, and shagbark hickory.

Some characteristics that children, and adults, can use to identify trees include the following: the shape of the tree; the shape and color of the leaves; the arrangement of leaves and branches on the tree; the color and type of bark; the type and color of flowers, twigs, buds, seeds, and fruits; and the presence or absence of thorns.

Trees of Illinois is the 61st Journey. Journeys are available without charge to any child who can read and write.

Field Museum's Journey program helps youngsters see and discover things of interest in the Museum. The program was begun in 1955 to teach any child who can read and write, how to use and enjoy the Museum. By using instruction-questionnaire sheets that direct the young people to exhibits illustrating a particular idea or theme, the children acquaint themselves with the Museum in small doses, and the Museum is not thought of as an awesome and unfriendly place.



Once a year—this year on April 14—awards are given to those who have successfully completed specific numbers of trips: Museum Traveler Award, four different journeys; Museum Adventurer Award, eight; and Museum Explorer Award, twelve.

After 16 Journeys, the child becomes a Museum Beagler and is eligible to take the final step in earning membership in the Museum Discoverers' Club. He receives a free copy of Charles Darwin's book, *The Voyage of the Beagle*, and after reading it, traces Darwin's voyage through the Museum halls to see some of the things Darwin saw on his famous voyage. It takes four and one-half years to qualify for membership in the Discoverers' Club.

Until he is 18 years old, the "Discoverer" is accorded Museum privileges similar to that of people holding annual memberships in Field Museum. He may also attend special meetings, such as the recent behind-the-scenes tour of the John G. Shedd Aquarium, conducted by Richard Vahan, Curator of Education at theAquarium.

The Journey program is open to boys and girls of all ages. Information concerning this free activity may be obtained at Museum entrances. ■

—George Fricke
Raymond Foundation Lecturer

CALENDAR OF EVENTS

March hours: 9 a.m. to 5 p.m. daily.

March 14 Spring Illustrated Lecture. "Minnesota Sand Country" by Walter J. Breckenridge. 2:30 p.m. in James Simpson Theatre.

March 16 NSF Anthropology Summer Science Training Program. Completed applications from high-ability high school students interested in this six-week course must be at the Museum today. The tuition-free program is offered from June 29 to August 7.

March 21 Spring Illustrated Lecture. "Coastal California" by Al Wool. 2:30 p.m. in James Simpson Theatre.

March 22 Roy Hay Speaks on British Gardens. The Garden Editor of The London Times and well-known authority will accompany his talk with a color motion picture, 3 p.m. in James Simpson Theatre.

March 28 Tibetan Carpets. A special temporary exhibit of 21 antique rugs and 25 modern rugs illustrating how refugee Tibetans have been able to resettle and develop a "new" handicraft based on an old cultural tradition. This free display from the Smithsonian Institution Traveling Exhibition Service continues in Hall 9 Gallery through April 26.

March 28 Spring Illustrated Lecture. "Canada's Mountain Wilderness" by Edgar T. Jones. 2:30 p.m. in James Simpson Theatre.

March 29 NSF Anthropology Summer Science Training Program. Personal interviews in the Museum for final selection of highest rating applicants begin today and continue through April 12. Announcement of final selection will be made on April 15.

Through March Spring Journey. "Trees of Illinois" helps boys and girls identify various types of trees common to this State. Any child who can read and write may participate in this free self-guiding year-round program. Journey sheets are available at the Museum entrances.

April 4 Museum Traveler Day opens Field Museum's free Spring film program for children. The movie will be preceded by the annual Journey Program awards ceremony beginning at 10 a.m. in James Simpson Theatre.

April 4 Spring Illustrated Lecture. "Houseboat to Florida" by Howard Pollard. 2:30 p.m. in James Simpson Theatre.

April 11 Spring Illustrated Lecture. "Alaskan Summer" by Mildred Capron. 2:30 p.m. in James Simpson Theatre.

April 11 Free Spring Film Program for Children salutes the Cub Scout at 10 a.m. in James Simpson Theatre.

Continuing Field Museum's 75th Anniversary Exhibit—A Sense of Wonder, A Sense of History, A Sense of Discovery—continues indefinitely in Hall 3. The scope of the Museum's many activities since its founding in 1893 is excitingly portrayed in this trend-setting exhibit.

MEETINGS:

Chicago Mountaineering Club, March 12, 8 p.m.
Illinois Orchid Society, March 15, 2 p.m.
Friends of Our Native Landscape, March 29, 2 p.m.

FIELD MUSEUM OF NATURAL HISTORY

Roosevelt Rd. at Lake Shore Dr.
Chicago, Illinois 60605

Founded by Marshall Field, 1893

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BULLETIN
FIELD MUSEUM OF NATURAL HISTORY
Volume 41, Number 4 April 1970

THE WHITE HOUSE

WASHINGTON

February 20, 1970

Dear Mr. McDowell:

One of the highlights of my recent trip to Chicago was the pleasant opportunity to visit the Field Museum of Natural History.

I just want to thank you and the members of your staff for your expert assistance in preparing for the CEQ Conference. Your cooperation helped to make this a successful and meaningful occasion.

With my appreciation and best wishes,

Sincerely,

Richard Nixon

Mr. Remick McDowell
President
Board of Trustees
Field Museum of Natural History
14th & Lake Shore Drive South
Chicago, Illinois 60605

MEMBERS' NIGHT MAY 8, 1970

Spring Open House from 6 to 10 p.m.
Featuring Treasures of the Museum

"Treasures" can mean many things to different people. An object can be unique because it is old, rare or has an unusual story connected with it, or any number of other reasons.

Highlighted will be Field Museum's most recent acquisition —a first-edition copy of John James Audubon's "The Birds of America," on display for the first time. The full story about this magnificent four-volume edition will appear in the May BULLETIN.

Members' Night is a once-a-year opportunity to get to know the Museum and participate in its many activities. Like a giant iceberg, only a small fraction of its vast collections is visible to the public. This evening is set aside to acquaint members with Field Museum's every-day program of activities, research, education, exploration and publication. Don't miss these events:

A Treasure Hunt in the Museum—For youngsters and anyone else who wants to join in the fun.

Entertainment in Stanley Field Hall.

Program in James Simpson Theatre.

PHOTO BY HOMER HOLDREH

Above, *the "Snowy Owl," drawn by Audubon in the open country of the United States in the early 1800s.*
(Photographed from the folio)

Behind-the-Scenes—Many members look forward to an evening's browsing in the research areas. All departments have planned special offerings and staff members will be available to explain and answer questions on exhibitions. Departmental offerings include:

Department of Anthropology

Tea in the East Asian Study and a showing of jade
Treasures from different eras and areas
Some interesting paleolithic tools
A project underway in the Conservation Laboratory

Added Extras: Special anthropology tours in exhibit areas and a look at the new Neanderthal family in the sculpture studio.

Department of Botany

Books as treasures
The Herbarium as a treasure house of knowledge
Treasures in Halls of Economic Botany and Plant Families
Books of special interest to the gardener
Outstanding materials from the Economic Botany collection

Department of Geology

A major exhibit: "Our Dynamic Earth." See a geyser that erupts every 5 minutes; a volcano that erupts every 15 minutes; air masses over Chicago; the genesis of rocks and minerals.
Pit Eleven fossils
More interesting igneous rocks
Washakie Basin stratigraphy
Fossil fishes

Department of Zoology

Exhibition of extinct and rare birds
Rare mammals of the scientific study collections obtained by early Museum expeditions
Demonstration: How to make an insect collection
Display: Large and showy tropical insects
Scanning electron microscope photos, a new technique for studying tiny insects
Anatomical specimens of the Giant Panda
A selection of marine shells from the newly-acquired A. L. Goodwin collection
Display: Spectacular specimens and unique types of fishes

Exhibit: Rare and interesting reptiles and amphibians

Bit by bit the environment changes, variety lessens, and species disappear. Right, *extinct Carolina Parakeet.*

EXTINCTION STRIKES 10,000 SPECIES, MAN REMAINS UNCONCERNED

by Alan Solem, Curator of Lower Invertebrates

PERHAPS the saddest aspect of being the curator of a biological collection today is the glum knowledge that each year more of your special world vanishes forever. Its passing causes not a ripple.

Sure, some things are saved. Heroic publicity measures and dedicated fund raising saved for the "Prairie State," Illinois, one scrap of virgin prairie, Goose Lake in Grundy County. One stand of white oaks, Beall Woods, stands near the Wabash River rather than lying as charred barrels in Scotland aging whisky.

I like Scotch whisky, but I also like forests. Our world needs both. The Passenger Pigeon is gone and books are written about it. The Whooping Crane barely survives. *Life* magazine (January 9th, p. 84) includes under "trivial trends that point the way" the fact that Whooping Cranes increased from 33 in 1960 to 55 in 1970.

Yet, when I say that man has wiped out 10,000 species of insects and snails in the last 200 years, at most there are raised eyebrows. "So what," is the usual comment. Even those most devoted to the preservation of natural areas and the saving of rare and endangered species are unaware of this fact. Under my Christmas tree this winter was a copy of the beautifully-produced "Wildlife in Danger" by James Fischer, et al. This surveys the current status of endangered species as determined by the International Union for Conservation of Nature and Natural Resources. It has 149 pages on mammals, 152 on birds, 14 on reptiles, 3 on amphibians and 13 on fishes. There is no mention of lower organisms.

It is unrealistic to expect otherwise. Western man long has operated with the view that the world is here for human exploitation. This is epitomized by Pope's "The Proper Study of Mankind Is Man." We are more than uncaring. We are almost totally anthropocentric.

Webster's Unabridged—

Anthropocentric: man as the center or ultimate end.

More like man, more interest; less like man, less interest. This shows in our language, our actions, and even the staffing of Field Museum (see boxed table). Yet cracks appear in our egocentric armour. "The Naked Ape" and "The Territorial Imperative" became best sellers by calling attention to the animal aspects of human behavior. Pollution is past the point of being ignored. It is a basic fact that no organism can live on its own excrement. Look at our rivers. Breathe our city air. We have been trying very hard. The tidal waves of debris from our sewers, smokestacks, automobile exhausts, garbage cans and factory waste outlets threaten disasters. Lip service to a clean environment replaces flag and motherhood in political speeches.

We are learning a lesson known to primitive tribes for many centuries. Man *shares* this world with other organisms. We need them and they need us. The oxygen we breathe is a waste product of plants. The carbon dioxide plants use is a waste product from animal bodies. Energy from the sun is used by algae and land plants to make organic chemicals. Animals get their organic chemicals either by eating plants or by eating animals that have eaten plants. Decay organisms, mainly bacteria and fungi, reduce the dead bodies of animals and plants to simple chemicals. These are then used again in the cycle of life. All life on earth is linked into a vast interdependent *ecosystem.*

If we break this chain of inert to living to inert, life on earth would cease. Warnings by ecologists of dangers from pesticides, thermal pollution and habitat destruction appear in mass circulation magazines. By 1972 the words "ecology" and "ecosystem" may be as familiar as "astronaut" and "spaceship." We must have plants, and animals, and birds, and even snails and insects. Yet exploding human populations continue to encroach on the environment. A fancy way of saying wipe it out.

It occurs in big ways. And in small ways. The next 30 years will see all forests in Central America cut down and gone forever. Incredible and pessimistic? Not to a biologist who has been there. Urban areas grow. Suburbs build up to uninterrupted vistas of manicured grass, concrete and asphalt, at most sprinkled with trash. Many biologists of my generation were weaned on vacant lots, redolent with dusty weeds on hot August days, singing with myriad insects and birds. Between digging forts and playing hide and seek in the long grass, our eyes were caught

by the red and black of a milkweed beetle, the grace of a fluttering butterfly, or even the shimmering back of a resting slug beneath an abandoned cardboard box. Curiosity, interest, avocation, profession followed in tidal sequence. Now these lots have houses, or at best are neatly asphalted play lots, routinely sprayed against mosquitos.

Bit by bit the environment changes, variety lessens, and species disappear. It may be robins from a city, buffalo from the Great Plains, or snails and insects from "some enchanted islands" rising dot-like from the vast Pacific. For here alone our 10,000 species vanished, mostly within the span of living centenarians. Item: In the 1870's an American missionary, Andrew Garrett, collected 13 species of endodontid land snails on Rarotonga in the Cook Islands; in 1965 there were only 2 remaining. Item: Living endodontid land snails were found on Mangareva, Gambier Islands in the 1840's; in 1934 only the dead remains of 25 species were found. Item: Of perhaps 125 species of Hawaiian endodontid land snails still living before 1850, probably less than a dozen exist today. Item: In 1948 a Hawaiian entomologist, Elwood Zimmerman, could state concerning the native insects "that to say a third or more of the species are now extinct would be no exaggeration." Since there are perhaps 6,000 species of Hawaiian insects known from collections in this century, this means a mere 3,000 species were gone by 1948. More have vanished since. Add another 2,000 for the Marquesas, denuded of forest to 3,000 feet by the mid-1920's, plus the loss of 2,000 species from the Society Islands—Tahiti, Moorea, Bora Bora. There are still the Austral Islands, Cook Islands, Samoa, Fiji, their vanished species unreckoned. The leeward dry regions of the Hawaiian Islands contained 60% of the native tree species. These have been stripped to nearly 5,000 feet. How many species gone? We don't know. But plants, and snails, and insects combined? Ten thousand is a modest estimate.

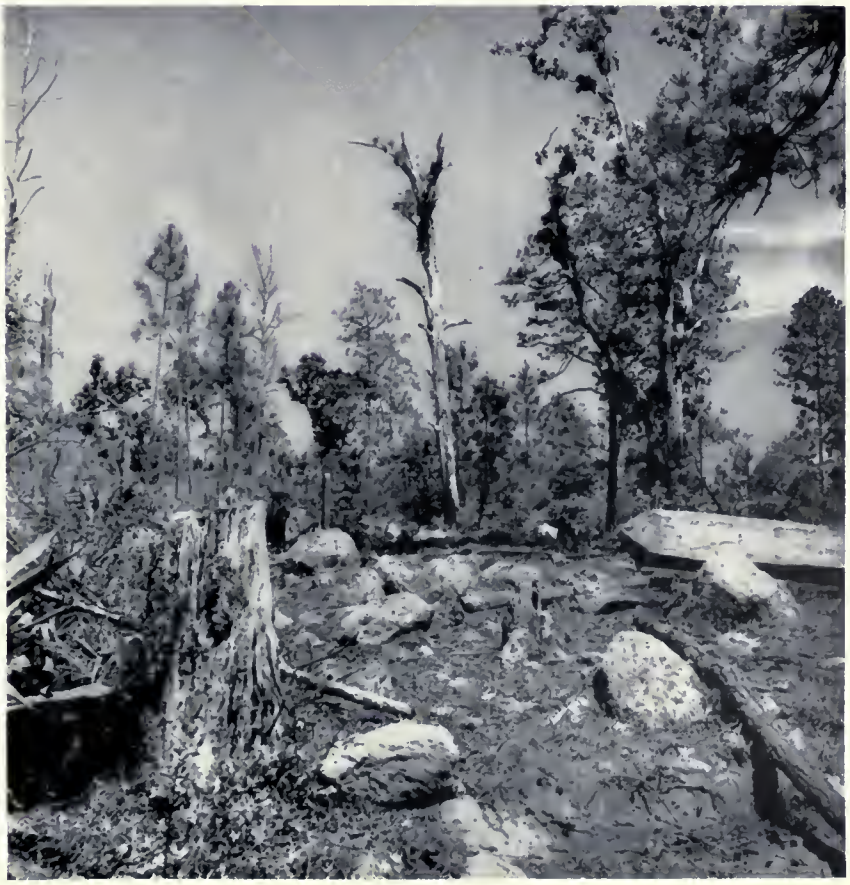
Why did they go? It was not only by deliberate hunting. It was not all the fault of Western man. When the Maoris reached New Zealand about 950 A.D., there was a bird fauna of perhaps 150 species. The large and edible moas were hunted and killed, but this covers only about 20 species. Another 30 species disappeared by 1900 because of habitat disturbance.

Habitat disturbance brings vision of bulldozers and factories. On islands it is much simpler. Cattle trample through native forest. An ornamental garden fern goes wild and chokes out thousands of acres a year in Hawaii. A potted garden plant from overseas had a few unnoticed ants. Within a decade *Pheidole megacephala*, a voracious species of ant, occupied lowland Oahu, destroying insects and snails alike. For several years I've been studying endodontid land snails. On Pacific Islands there is a neat and simple equation:

Introduced ants = no ground dwelling endodontids. Even more so for many insects.

So I'm writing about the species that were, or occasionally (still) the species that barely are. On Upolu, Western Samoa, a beautiful little land snail called *Thaumatodon hystricelloides* was common in the woods behind the port of Apia in 1865. In 1965 it was restricted to high mountain peaks, the only areas from which introduced ants still were absent. The question is not *will* it become extinct, but *when*. Islands were treasure troves of evolution, but the carelessness of man's introductions threatens to turn them into wastelands. Eighty-five of 94 birds species thought to have become extinct since 1900 lived on islands.

(*continued on next page*)



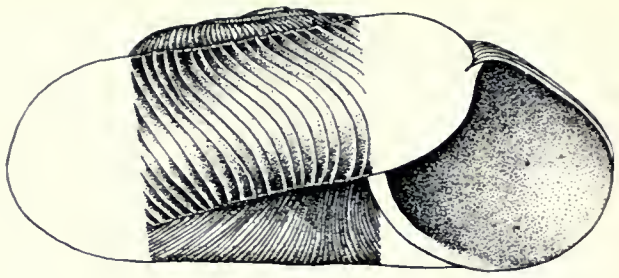
The next 30 years will see all forests in Central America cut down and gone forever.
PHOTO BY DR. LOUIS WILLIAMS

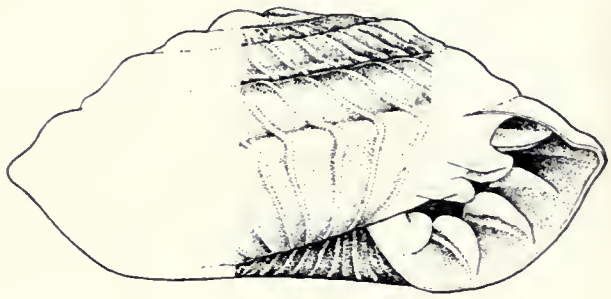
But extinction strikes closer to home. A new subdivision in California results in bulldozing the only known habitat of a land snail into oblivion. Colorful Florida tree snails are extinct over thousands of acres in the Miami–Homestead area as the tangles of trees and vines were replaced by houses. Resorts and retirement houses fill the Florida Keys and more snails are nearly lost. They are gone from their original home, but survivors have been transplanted into the Everglades National Park by a few dedicated naturalists. So some were saved.

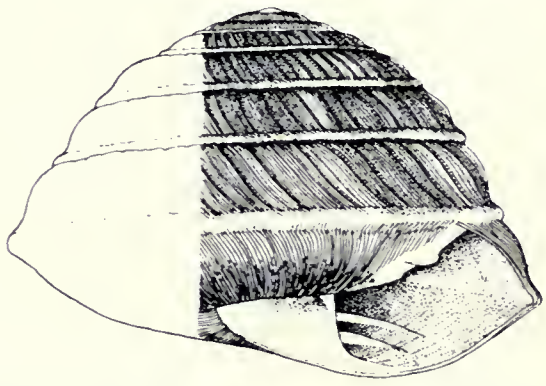
Even land snails have a few partisans. And I plead guilty to a somewhat malacocentric outlook. But many, many species are on the verge of extinction. There are only a handful of malacologists. Should the few of us collect and preserve samples from populations of the vanishing species? If we do this, there will be a bottled remnant in museum jars for our successors to study. But if we scramble to snatch these samples of vanishing forms, there is not enough time for study of what we get, nor for attempts to save and preserve. If we study some, then many will be lost without a trace. If we try to save a few, then neither collection nor study is possible.

No choice is easy. The island snails that I now study are vanishing rapidly. Saving them is not possible. Introductions of domestic animals, plants, and insects have set in motion habitat changes that doom the snails to extinction. Unlimited money, help and cooperation would not be sufficient to reverse the trends. So I collect and I study. When I can, I help efforts to save natural areas and preserve endangered species. This still is little compared with the need.

"Can man survive?" is the question now raised. Environmental catastrophies are predicted and occur. Crash programs on ecology will be called for and organized. The call of "relevance" in teaching and social work is being extended to science and research. The need for practical results to aid man's survival reduces the funds for basic research in the middle of inflation. Our awareness of dependence on other life forms ironically is breeding a new round of anthropocentrism. Will there be room on earth for insects and snails? Will there be room for students of them? ■







Yet, when I say that man has wiped out 10,000 species of insects and snails in the last 200 years, at most there are raised eyebrows.

. . . the anthropocentric staffing of Field Museum . . .

Group of species	No. of species in each group	No. of curators working on these species	No. of species each curator "manages"
Man	1	7	0.14
Mammals	4,190	2	2,085
Birds	8,590	3	2,863
Reptiles Amphibians	8,500	2	4,250
Fishes	40,000	1	40,000
Lower Invertebrates	175,000	1	175,000
Land Arthropods	910,000	2	455,000

If Field Museum decided to have as intensive study of land arthropods as we do of mammals, we would need 436 curators for land arthropods. Actually, only about 50% of the insect, mite and spider species are known, while nearly all mammals have been described. A more realistic need would be for 872 curators for land arthropods.

Market place before Santo Tomás Church in Chichicastenango, in the Guatemalan highlands, is the scene of processions and ancient Maya rituals on All Saints Day PHOTO BY RODOLFO REYES JUAREZ

Natural History Tours

Guatemala, Britain, Andes-Galapagos

Vivacious Pokoman girl, from Antigua wears colorful dress of her community

PHOTO BY RODOLFO REYES JUAREZ

Field Museum's popular Guatemala Tour, which in the fall of 1967 opened the Museum's program of natural history tours, will be repeated October 24 – November 8. Announcement was by Phil Clark, Natural History Tours Chief, who will lead this as well as the British and the Andes–Galapagos tours.

The Guatemala Tour will offer vivid color and dramatic contrasts—pine-clad mountains and lowland tropical jungles, Indian markets beside volcano-ringed Lake Atitlan, Antigua's time-softened Spanish Colonial ruins and Tikal's white Mayan temples rising over green rainforests, aristocratic gardens on vast coffee fincas. It will climax with the drumming, chanting, dancing, incense and fireworks of All Saints Day at Chichicastenango. Tour members will visit private homes and gardens and will be given expert guidance throughout by an archaeologist and a botanist, as well as Guatemalan guides.

Tour price is about $1,280, including $400 tax-deductible donation to Field Museum, and covers all costs except minor tips. Mail the $400 deposit to Field Museum Tours, Field Museum, Roosevelt Rd. at Lake Shore Dr., Chicago, Ill. 60605, and your reservation will be assured. The tour is limited to 30 persons.

Important news also is that the price of the British Tour, May 30 – July 4, has been reduced, due to changed group air fares, by $240, lowering the total price to $2,205 for the five weeks. The tour is limited to 25 persons.

Another tour development is that it is now possible to take the Galapagos section of the Andes–Galapagos Tour separately, for $1,190, including a $250 donation. The 11-day trip features the eight-day Galapagos cruise on the ship *Lina A* and two nights and one day of sightseeing in Quito. Dates are January 20 – 29 for the first group and February 24 – March 5 for the second. The total tours "The Inca's Empire and Darwin's Galapagos," are scheduled December 31 – January 29, 1971, and February 4 – March 5, for $2,807, including $600 donation. The 22-day segment alone is $2,457, including $600 donation.

Reservations for the British or Andes–Galapagos tours may be made by mailing deposits equaling the donations, to Field Museum Tours, at the above address.

Conway Castle, Wales

Galápagos tortoise PHOTO BY GRANT HAIST, ROCHESTER, N.Y.

TIBETAN CARPETS:

A highly colorful exhibit of Tibetan carpets opened at the Field Museum March 28. Forty-six rugs, 21 of them antique and 25 of them modern, are included in the collection which will remain on display through April 26.

Organized by the Swiss Office of Technical Co-operation, the showing is sponsored by the Smithsonian Institution Traveling Exhibition Service and His Excellency Felix Schnyder, Ambassador of Switzerland.

Contemporary carpet with floral design

Tibetan weaver at work at a rug-making center

PHOTO BY JOHN MOYER

old designs for a new way of life

Carpet of contemporary origin utilizes antique dragon motif

Switzerland has pioneered in helping the many thousands of refugees who fled from Tibet in 1959 and 1960 to neighboring Nepal and India to become resettled and learn self-sustaining trades. In 1963, with Swiss aid, three centers for handweaving were established in Nepal: in Chialsa, Pokhara and Katmandu. Tibetans with no previous skills were trained in all aspects of rug-making, from dyeing of wool to design and weaving. The centers were given the status of independent producing companies with a Tibetan management in 1966, to help motivate a sense of responsibility and enthusiasm among the workers. It is the Nepalese rug industry that provides the major contribution to the exhibit.

Commenting on the Swiss effort, Ambassador Schnyder said, "It is an example of how you can teach people in developing countries to help themselves. This is the Swiss ideal of democracy. It is also important that in this case the new handicraft is developed on the basis of an old cultural tradition."

The art of making pile carpets was taken up by Tibetans in relatively recent times, at the earliest in the eighteenth century, though carpets were known to them much earlier. Nomads who traversed the vast regions of Northern Central Asia carried them as objects of daily use. Numerous cultural ideas and motifs found their way along the pre-historic trading routes, and, as can be expected, many of these reached the Tibetans in the remote past.

The saddle carpet was the most widely used in Tibet and still is in the Himalayan mountains of Bhutan. On long caravan expeditions they were a necessity and occasionally were spread on the ground to sit upon.

After the introduction of pile carpet-making, the beautiful old symbols and designs were adapted to the new technique. With the passing of time, the intrinsic significance of these symbols had undergone changes and they were endowed with new meanings. Motifs that had been woven, carved, embossed, cast in metal or appliqued were repeated in the designs of the pile carpets. Thus, many ancient symbols have survived to the present, among them the snow lion, which appears today on the national flag of Tibet, the dragon and the phoenix.

Variations of the eight Buddhist symbols of good fortune are important decorative motifs. Rows of spirals, fretwork and flower patterns help reinforce the kinship of these carpet designs to those common in Asia. The often-used geometric meander is among the oldest designs in existence, having appeared on neolithic pottery made by tribes that migrated from Central Asia to Ancient China.

The distinctive designs, together with the high quality of the wool and the brilliant colors, have popularized the new carpets and production is steadily increasing. The ultimate goal of the enterprise, the full economic independence of the Tibetan community in Nepal, will become a reality only when their products find a ready acceptance in the world market.

A visit beforehand to Field Museum's permanent exhibit "Tibet, High Land of Monk and Nomad," will orient the visitor and help him to put the carpet display into proper perspective. ■

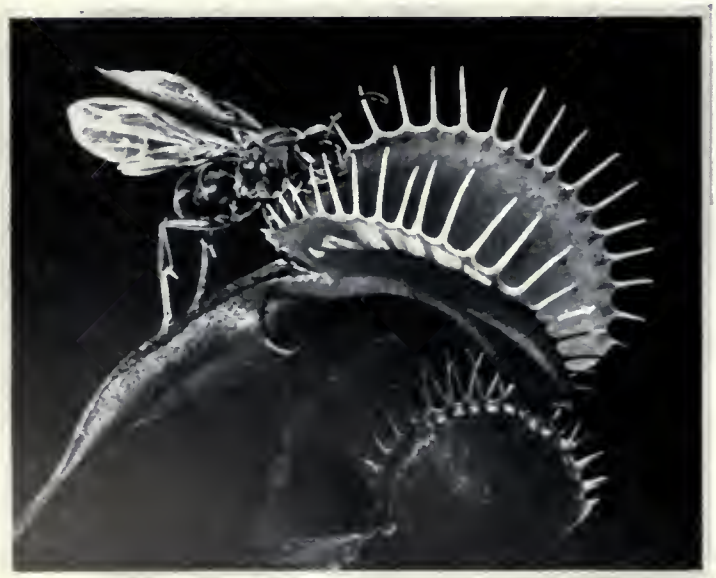
25th CHICAGO INTERNATIONAL EXHIBITION OF

For the 25th year, Field Museum recently presented the Chicago International Exhibition of Nature Photography. Under the joint sponsorship of the Nature Camera Club of Chicago and the Museum, this yearly exhibition is one of the world's oldest and largest showings of nature prints and slides. The competition is sanctioned by the Photographic Society of America.

This year entries were submitted by more than 800 photographers in 40 states, Washington, D. C., Canada, and 14 other foreign countries. Awards were given to the best print and slide in three categories: animal life, plant life, and general. Special awards included Photographic Society of America medals for the print and slide judged best in show and best in authenticated wildlife; Myrtle R. Walgreen silver bowl for the best color print; and Alice Cook Memorial medal for the slide best illustrating natural scenery.

PATTERNS
Honorable Mention
Merle Watson, Sarasoto, Florida

EVERGLADE ELEGANCE/ NCCC Medal ➤
Best Animal Print
Earl Kubis, Downers Grove, Illinois



VENUS FLY TRAP/NCCC Medal
Best Plant Print
Joe Timmer, Grand Rapids, Michigan
➤

ON PLANET EARTH/PSA Medal
Authenticated Wildlife
A. D. Edgar, River Forest, Illinois

On this month's cover—"Blick Vor Dem Sprung"—honorable mention award photograph by Leo Vrana of Vienna, Austria captures a decisive moment in the life of a rodent.

HALF DOME—YOSEMITE/NCCC Medal
Best General Print
J. Curtis Mitchell, Chicago, Illinois

(continued on next page)

GULF FRITILLARY #4
Honorable Mention
C. W. Bischofshausen, Fort Worth, Texas

REFLECTIONS/PSA Medal ➤
Best Print in Show
Henry A. Shull, Darien, Connecticut

LYCOPERDON MOLLE/Walgreen Award
Best Color Print
R. M. Kleinschmidt, Rochester, New York

Strange as it may seem, to study Peruvian vegetation a scientist normally visits the Field Museum first before traveling to Peru. Why? Because over a period of more than 40 years, Field Museum has developed its collection of Peruvian flora into the world's best and most complete source of information for anyone interested in the botany of Peru.

Today, the Museum continues its interest in Peruvian flora through the work of Dr. Donald R. Simpson, Assistant Curator of Peruvian Botany, and his field assistant Sr. Jose Schunke. With support from a National Science Foundation grant, Dr. Simpson is helping the Peruvian Forest Service gather information on forest resources in the westernmost region of the Amazonian jungle of Eastern Peru. What follows is a description of his trip inland and the start of his expedition.

flight across the Andes

by Donald R. Simpson
Assistant Curator in Botany

LEAVING Lima the two-motor DC-3 heads out to sea, in the opposite direction from our destination, a town located beyond the Andes Mountains in the Amazon Basin. Just out from land, over the Pacific Ocean, the plane begins a slow spiral climb, a necessary prelude to crossing the mountains. The westernmost ridges of the Andes rise so abruptly from the narrow Pacific Coast desert that there is not enough room over the land to gain altitude for crossing the mountains. Finally we reach the desired elevation and leave the ocean behind.

As the plane heads inland, one can see that the brown, bare mountainsides become tinged with green as we proceed eastward. Now a scrub vegetation appears, where at lower elevation there was only sand, dust, and rock, and a little higher there are small terraced fields surrounding tile-roofed villages. There is enough rain at this altitude to make possible some agriculture. Higher still it is too cold for crops, the fields are replaced by vast stretches of barren grasslands and rock fells, with here and there a sheep corral and adjacent shepherd's hut, both built of crude stone.

Above this cold, barren highland rise the great jagged snow-covered peaks. This part of the Andes, called the Cordillera Blanca or White Mountains, includes Peru's highest peak (22,205 ft.). They present a dramatically exciting panorama whether seen from the air or from the adjacent Huallas Valley (pronounced Wi-yas). This highland is often partly hidden from view by big, fleecy, white clouds that are pushed up from the humid Amazon Basin. As the plane makes its way through these clouds, every few seconds there is an opening on one side or another through which is revealed breathtaking scenes of enormous jagged peaks with sides covered by snowfields and glaciers.

Something else is breathtaking, literally so. You first notice it when you reach about fifteen thousand feet altitude. The cabin is pressurized, partially, but a light-headed sensation tells you something is amiss. The stewardess comes by explaining that we are to take one of the thin rubber tubes connected to wall nozzles beneath the window and breathe the oxygen being supplied through it. Crude though it sounds, it is effective and when, after putting the oxygen tube down to take photos for a couple of minutes, the feeling of light-headedness returns, one has to take time out again for a few breaths of oxygen.

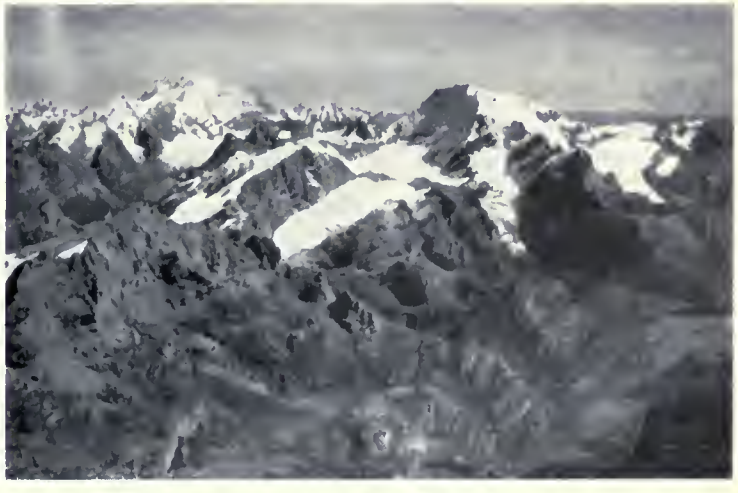
As we cross the highest ranges and continue eastward the land below changes rapidly from the high, barren mountainsides to mountain valleys with bright green irrigated fields. Beyond, lower mountain ridges show more green as patches of woodland appear in moist swales and canyons. A little further and the trees cover most of the hillside; the transition from grassland to forest is almost abrupt.

Now we are over the great "selva" itself, that almost unbroken tropical rain-forest that starts here on the rolling eastern foothills of the Andes and flows away to the Atlantic coast of Brazil nearly two thousand miles away. "Selva" is the Spanish word for any forest or jungle, but in Peru there is another term, "La montana" that one commonly hears in conversations about the "selva." "Montana" is Spanish for mountain and has that meaning in most of Latin America, but in Peru it means the forest region of the flat, eastern lowland part of the country.

The forest-covered foothills soon give way to a vast flat plain, where dense jungle extends as far as one can see. The forest covering seems to be broken only by occasional meandering rivers and streams. Soon one can see that we are approaching a very broad river and near its margins a number of oxbow lakes. This is the Ucayali, one of the main Peruvian tributaries of the Amazon.

The plane has been descending slowly since passing the crest of the mountains, and as we approach the river we are only a few hundred feet above the tree tops. The air in the cabin has become warm and humid; we are aware now that clothing appropriate for Lima will not do here. Our destination is Pucalpa, a fast growing frontier town and river port on the banks of the Ucayali River.

As the plane approaches the runway it passes low over one of the oxbow lakes, then a strip of cut-over forest, and finally the cleared ground of the airfield. We get a fleeting look at palm trees seen from directly overhead, a beautiful pattern that one remembers long after. Now the plane, on the ground, rolls to a halt near the newly-built, one-room terminal and the doors are opened. Immediately the air becomes still warmer and the humidity must be near one hundred percent. This is our introduction to "La montana." ■



Above the cold, barren highland rises the snow-covered Cordillera Blanca.

OF GEMS AND THINGS

by Edline Chun

Since the founding of the Field Museum, specimens acquired as gifts have contributed greatly to the Museum's resources. This is still true, as evidenced by three recent collections.

Currently exhibited in the North Lounge of the Museum until May 4 is a rare carbonaceous stone meteorite, a gift of Mr. Reinhold Groh of Barrington, Illinois. A large natural spinel, a gift from Mr. Chester Dudley Tripp of Chicago, and a 33.27-carat tanzanite of the blue variety discovered only in 1967, donated by Tiffany and Company of New York, will soon be displayed in Higinbotham Hall of Gems on the second floor of the Museum.

In commenting on the meteorite, Dr. Edward Olsen, Curator of Mineralogy, explained that carbonaceous stone meteorites are a rare type of meteorite which scientists call "carbonaceous chondrites."

They form a distinct group in that they contain significant amounts of the element carbon in the form of numerous organic compounds. Such compounds are absent or extremely rare in all other meteorite types. Until very recently, he said, it was thought that the presence of these compounds indicated biological activity on the original planet from which these meteorites came.

"Over the past five years," Dr. Olsen continued, "it has become increasingly clear that carbonaceous chondrites are the result of non-biological chemical reactions, and imply nothing regarding possible other life in space, other than to learn that such compounds are readily formed on other planetary bodies and may, in right conditions, provide a basis for life to begin."

While the occurrence of carbonaceous condrites on earth is rare, the recently completed investigations of the Apollo XI lunar samples indicate that the so-called lunar "soil" may contain up to two percent of this meteoritic material, Dr. Olsen said. Meteorites falling onto the lunar surface, he said, were the source of the material.

On Feb. 8, 1969, at 1:09 a.m. (CST), a brilliant meteorite shower occurred over the State of Chihuahua, in northern Mexico. Spread over an area approximately 100 square miles, the shower is one of the largest carbonaceous chondrites ever known to fall. Most of the fragments are about the size of oranges and range down to the size of a walnut. Some of them, however, were larger, and it is one of these larger pieces, 32 pounds in weight, which Field Museum acquired through the generosity of Mr. Groh.

"Mr. Groh's gift is an excellent exhibit-sized specimen," Dr. Olsen said. It has been named "Pueblito de Allende" for the small town near where it fell.

giant natural spinel

The spinel, Dr. Olsen continued, is a tumble-polished natural stone of transparent reddish-brown color. It has been drilled through so that it might be worn as a pendant.

The precise faceting of gemstones, from a historical viewpoint, is a relatively recent art, Dr. Olsen said. Many of the famous ancient stones were faceted by crude hand-held methods and were not particularly symmetrical, nor very highly polished.

"In some instances a stone was tumble-polished to brighten its natural colors, but leaving its original shape pretty much unchanged," he said. Such is the gemstone donated by Mr. Tripp.

"This spinel is a giant among natural spinels, weighing 194.11 carats," Dr. Olsen said. Most natural spinels are a few tens of carats in weight.

"This particular stone," he continued, "is thought to have been part of an Indian maharajah's collection and appears to date back to the Mogul empires of the mid-17th century."

The stone is inscribed with Arabic characters, which were translated for the Museum through the courtesy of the Oriental Institute of the University of Chicago. The stone bears the name "Nur Jahan" and the date "1054."

"By our calendar, this is 1644 A.D.," Dr. Olsen remarked.

Speaking of the Tiffany gift, Dr. Olsen explained that almost all gemstones come from ancient times, and new entries to the time-honored list of gems are unheard of. Tanzanite, however, is a gem mineral discovered in July 1967 in Tanzania, near Mt. Kilimanjaro. Named and brought to the attention of the world by Tiffany and Company, the deep blue gem has since gained great popularity.

Its deep blue color closely resembles a Burma sapphire, said Dr. Olsen, in describing the gem.

He explained that tanzanite is actually a well-known mineral called "zoisite." Zoisite is normally a dull creamy-white, unattractire mineral that occurs in a variety of metamorphic rocks. In this particular instance, it occurs as large transparent crystals and is grayish in color. If these crystals are carefully and gently heated, they may turn permanently to the startling blue gem color, and are then called "tanzanite."

33-carat tanzanite (actual size)

Up to now Field Museum was able to obtain only a relatively small tanzanite. However, Mr. Henry B. Platt, Vice President of Tiffany and Company, recently offered

rare stone meteorite

Field Museum a gift of a large tanzanite. Arrangements were completed early this year, and the beautiful antique cushion-shaped stone will soon be installed in the Hall of Gems as a gem specimen for color and cut.

With this gift from Tiffany and Company, a relationship dating back to 1893 is resumed. The nucleus of Field Museum's world-famous gem, precious stones, and jewelry collection in Higinbotham Hall was originally exhibited in the Tiffany Pavilion at the World's Columbian Exposition. Tiffany's award-winning collection was purchased by Mr. H. N. Higinbotham for presentation to the Museum and is known as the Tiffany Collection.

Early Museum records show that mainly through the interest of George Frederick Kunz, Tiffany's renown mineralogist-gem expert, Field Museum was able to obtain items from the company for its young collections. Today these early acquisitions are among the prize specimens of the Department of Geology, as well as the Department of Anthropology. Gold and silver ornaments of the Pre-Columbian Period from Ecuador, Mexico, and Florida, acquired from Tiffany and Company 76 years ago, are among the Museum's anthropological collections displayed in Halls 4, 8 and 9.

Museum Director E. Leland Webber termed the three gifts welcome acquisitions. "In view of increased operating costs, which have almost eliminated funds available for acquisitions," Mr. Webber said, "gifts of specimens are more important to Field Museum than ever before. A great museum is built on great collections. We hope that those interested in the Museum will continue to help us fill gaps when opportunities arise." ■

CALENDAR OF EVENTS

April hours: 9 a.m. to 5 p.m. daily.

The Museum Library is open to 4:30 p.m. daily.

April 11 SPRING ILLUSTRATED LECTURE. "Alaskan Summer" by Mildred Capron. 2:30 p.m. in James Simpson Theatre.

April 11 CHILDREN'S FREE FILM SERIES. Today's program honors the Cub Scout. 10:30 a.m. in James Simpson Theatre. This free activity is open to youngsters of all ages.

April 15 NSF ANTHROPOLOGY SUMMER SCIENCE PROGRAM. High school students selected for Field Museum's six-week course are notified today.

April 18 SPRING ILLUSTRATED LECTURE. "Fiji, Samoa, Tonga" by Nicol Smith. 2:30 p.m. in James Simpson Theatre.

April 18 CHILDREN'S FREE FILM SERIES. Today's program salutes the Girl Scout. 10:30 a.m. in James Simpson Theatre. All boys and girls are welcome to participate.

April 25 SPRING ILLUSTRATED LECTURE. "Mukar Beh" by Dennis Gray. 2:30 p.m. in James Simpson Theatre.

April 26 AUDUBON WILDLIFE FILM. "Village Beneath the Sea," by Harry Pederson, examines life in a small isolated coral formation. 2:30 p.m. in James Simpson Theatre.

April 26 TIBETAN CARPETS. This colorful temporary exhibit in Hall 9 Gallery ends today. Organized by the Smithsonian Institution Traveling Exhibition Service, the collection of antique and modern rugs is under the sponsorship of His Excellency Felix Schnyder, Ambassador of Switzerland.

Through April SPRING JOURNEY FOR CHILDREN. "Trees of Illinois" continues through the month to May 31. The free self-directed tour helps boys and girls identify various types of trees found in the State. Any child who can read and write may participate in the program. Free Journey sheets are available at the Museum entrances.

May 4 RARE CARBONACEOUS STONE METEORITE. Today is the last day to see the latest addition to the Museum's famous meteorite collection. Visit the special display case located in the North Lounge of the Museum.

May 8 MEMBERS' NIGHT, 6 to 10 p.m. Annual spring open house features treasures of the Museum, behind-the-scenes activities and special programs.

Continuing 75TH ANNIVERSARY EXHIBIT: A SENSE OF WONDER, A SENSE OF HISTORY, A SENSE OF DISCOVERY continues to captivate all who visit this trend-setting display in Hall 3. The free exhibit will be 1 year old next month.

MEETINGS

WINDY CITY GROTTO, National Speleological Society, April 8, 7:30 p.m.

CHICAGO MOUNTAINEERING CLUB, April 9, 8 p.m.

NATURE CAMERA CLUB OF CHICAGO, April 14, 7:45 p.m.

CHICAGOLAND GLIDER COUNCIL, April 14, 8 p.m.

ILLINOIS ORCHID SOCIETY, April 26, 2 p.m.

BOTANY CURATOR HONORED BY ORCHID SOCIETY

Dr. Louis O. Williams

Honorary Membership in the American Orchid Society has been conferred upon Dr. Louis O. Williams, Chief Curator of Botany.

Formerly Curator of the Orchid Herbarium of Oakes Ames at Harvard from 1932 to 1942, Dr. Williams also served as Editor of the American Orchid Society Bulletin from June, 1940 until December, 1942.

He is the author of several important books on orchids including *The Orchidaceae of Mexico*, *An Enumeration of the Orchidaceae of Central America*, *British Honduras and Panama*, and, with Mr. Paul Allen, *Flora of Panama—Orchidaceae*. Dr. Williams has published numerous papers on orchids during a period of thirty-five years, with a publication describing several new orchids to be issued shortly.

FIELD MUSEUM
OF NATURAL HISTORY
ROOSEVELT ROAD AT LAKE SHORE DRIVE
CHICAGO, ILLINOIS 60605 A.C. 312, 922-9410
FOUNDED BY MARSHALL FIELD, 1893
E. Leland Webber, Director

BULLETIN **FIELD MUSEUM OF NATURAL HISTORY**

Volume 41, Number 5 May 1970

John J. Audubon
From the original painting by Chappel, in the possession of the publishers
Johnson Fry & Co. Publishers New York
Entered according to act of Congress A.D.1860 by Johnson, Fry & Co. in the clerks office of the district court for the southern district of NY

MUSEUM ACQUIRES RARE AUDUBON FOLIO

A model of the flower of a milkweed, partially dissected open to show the structure, and complexity, of the flower. The figure at the lower left shows how a pollenium (pollen mass) is attached in the flower—the leg of a bee at the right shows pollinia that have become attached as the insect visited a flower of a milkweed. The pollinia will be transported to another plant, thus insuring cross-pollenation.

The beautifully marked flower of this Stapelia from southern Africa may be more than six inches across. The stems, which also serve as leaves, remind one of cacti.

milkweeds are milkweeds

by Louis O. Williams, Chief Curator of Botany

Milkweeds and weather have at least one thing in common. Everyone talks about the weather but does little about it. Everyone knows milkweeds, but most people, and botanists, leave them strictly alone.

The milkweeds, known to everyone who gets out into the edges of the cornfields, or waste-places, are occasionally abundant weeds often with attractive flowers. If you stop to pick a few of them you will find that they are filled with a sticky white latex, which inspired their name. Interest often lags at this point and the plant is cast aside. To most people milkweeds are of little concern, unless they happen to invade gardens or fields as they often do. However, if you investigate the milkweed family, botanically Asclepiadaceae, a name which is derived from Asclepias, the genus of the common milkweeds, you will find a family of nearly worldwide distribution and sometimes of bewildering floral diversity. Numerically, most milkweeds are found in the world's tropics and most of them share a common trait—the stems and the leaves, when broken, exude "milk."

The milkweeds that you may be familiar with around Chicago are erect plants, perhaps two to four feet tall. Erectness is an unusual characteristic in the family. I suppose that well more than 95 per cent of milkweeds are herbaceous or woody vines, sometimes rampant ones at that.

The world's milkweeds, and a very successful family of plants it is, have flowers that are sometimes unbelievably complicated morphologically. To the chagrin of many botanists, the flowers of some kinds may be as small as 1–25th of an inch long. These tiny flowers are as complex as flowers of other kinds that are an inch or often more long. Perhaps only among the orchids, a much larger family, is the flower structure more complicated, and in

both families it is so distinctive that it is all but impossible to confuse a member of one of these families with one from any other family of flowering plants.

The milkweeds are insect pollinated, perhaps without exception. The evolution of the complicated flower structures by which cross-pollination is assured, is almost beyond belief. At the same time one wonders how such complicated structures could have been developed and if this complexity really serves to make the family "successful." Is it not possible that such highly-evolved structures, ones that are presumed to assure the "success" of the family, become in fact so involved that they are self-defeating? It seems to me that this is a distinct possibility, as it may be among the more highly-evolved orchids.

In sharp contrast to the floral complexity of the milkweeds, their vegetative structure is disgustingly uniform. With few exceptions the stems and leaves of this rather large family offer little help in segregating it into genera—that is, one has difficulty placing a plant with its close allies based upon the aspect of its vegetative structures.

The study of the tropical kinds of milkweeds has been considered to be difficult by most botanists and often they have avoided them, when in fact, these plants seem to me to be one of the most fascinating families among the flowering plants. Certainly, they will repay in pleasure and knowledge the attention devoted to them.

The "common" milkweed in the vicinity of Chicago is *Asclepias syriaca*. Look into the edge of almost any field this summer and fall and you will find it, first in flower and later the ripened pods spewing seeds, with their silky appendages, into the wind. This is the milkweed that is shown in Field Museum's Hall of Plant Families (Hall 29, case 842).

Quite different from America's asclepiads are the attractive members of the family to be found in the south of Africa. Here are some of the most attractive plants of the family, with great star-shaped flowers, but the plant itself reminding one of the cacti. Many of these African plants with showy flowers are pollinated by flies that normally are attracted to carrion, and close approach to the flowers will indicate the reason. ■

Field Museum's model (in Hall 29, case 842), of Asclepias syriaca, *the common milkweed to be found in the vicinity of Chicago in summer and fall.*

All About Audubon

by William Fawcett, Librarian
Photos by Homer Holdren

The Museum has become the fortunate recipient, through an anonymous donor, of one of the finest copies of the elephant folio edition of John James Audubon's magnificent *The Birds of America*. This rare and beautiful work, one of the landmarks of American ornithology, was originally issued in London between 1827 and 1838 and consists of 87 parts of 5 hand-colored, copperplate engravings. The 435 aquatints, measuring 39.5 inches by 29.5 inches, were bound into 4 volumes and originally cost $1,000, no small sum in those days.

The Museum's copy is of particular value because it is one of two existing copies enriched with an additional 13 plates and was originally the property of Miss Euphemia Gifford, cousin and close friend of Audubon's wife Lucy. Audubon himself, according to a letter addressed to Miss Gifford, took "satisfaction in attending to the colouring and finishing of each separate Plate or Engraving . . ." and designed the "ottoman" with four drawers that has preserved the set so well.

At the Museum the folio will be displayed in a specially constructed glass case containing an environmental control mechanism which will maintain filtered air in the case at an appropriate temperature and humidity level. Large enough to permit one volume to be shown open, the case will also be equipped with a modern electronic burglary device.

The Birds of America was the fruit of many years of hard work, frustration and "rambling" in Audubon's "beloved America." Born on April 26, 1785 at Les Cayes, Santo Domingo (now Haiti), Audubon spent his boyhood in France, where he early evinced an interest in drawing birds. At the age of 18 he was sent to the United States to escape conscription into Napoleon's army and "to make money." He was by his own description "ill-fitted" for the latter and has written: "For a period of nearly twenty years my life was a succession of vicissitudes. I tried various branches of commerce but all proved unprofitable, doubtless because my whole mind was ever filled with my passion for rambling." It was during these rambles that his interest in drawing and studying our fauna, particularly birds, grew to such an extent that, by 1820, he decided to devote his entire efforts to illustrating North American birds. In order to accomplish this task he supported himself by painting portraits and giving drawing lessons and was also supported by his wife's teaching.

By 1826 he had enough material to consider publication and took his drawings to Europe in search of patrons and a publisher. There his work was very well received. In Edinburgh William Homes Lizars, the well-known engraver and printer, exclaimed, "My God, I never saw anything like this before," and agreed to engrave and publish the work. At the end of November, 1826 Audubon received proofs of the first five plates. "The work," he wrote in his Journal, "from what I have seen of Mr. Lizars' execution, will be equal to anything in the world at present, and of the rest the world must judge for itself." The illustrations were printed life size; and Audubon acknowledged that "it renders the work rather bulky, but my heart was always bent on it, and I cannot refrain from attempting it." With this first "number" he was ready to seek subscriptions and issued his prospectus on March 17, 1827. From this time until 1839 he travelled between Europe and America financing and overseeing the publication of *The Birds of America* and its text, titled *Ornithological Biography* (5 vols., 1831–1839), and index, *A Synopsis of the Birds of North America* (1839).

Great Blue Heron

Whistling Swan

Magnificent 'Birds' goes on display

One of the finest copies in existence of John Audubon's The Birds of America, *presented to Field Museum by an anonymous donor, will be placed on public display in the Museum's North Lounge, second floor, on May 9. One page will then be turned each day until all the 448 plates have been shown. Members of the Museum will enjoy a preview of the "elephant folio" on Members' Night, May 8.*

Lizars engraved the first ten plates but was stopped by difficulties with his colorers. After a considerable delay Audubon transferred the publication of his work to Robert Havell and his son "because the difficulty of finding colorers made it come too slowly, and also because I have it done better and cheaper in London." Together with skilled assistants, the son produced the plates and the father, under Audubon's direction, supervised the coloring. At one time 50 people were engaged in these tasks.

After publication of the final volume Audubon returned to the United States and settled in New York. Until his death on January 27, 1851 he continued his study of our natural history and produced other important works, including *The Viviparous Quadrupeds of North America.*

Audubon's life was a particularly fascinating and important one and interested readers will find the following two books by Alice Ford of great value: *John James Audubon* (University of Oklahoma Press; Norman, Okla., 1964) and *Audubon, By Himself* (Natural History Press —Doubleday; Garden City, N. Y., 1969). The original water-color paintings have been recently reproduced in 2 volumes (American Heritage Publishing Company; New York, 1966).

Members' Night, May 8 - Be sure to mark your calendar!

Long before Members' Night arrives, plans are underway in all of the departments for special exhibits and activities. Take this miniature landscape for example, complete with an active volcano that spews forth every 15 minutes. The youngsters were lucky enough to be around when staff members in the geology department were testing the exhibit. This is just one of the special attractions that await members, 6:00 to 10:00 p.m. on May 8.

Here are some of the highlights behind the scenes:

A look at the new Neanderthal family; botanical books as treasures; anatomical exhibit—Giant Panda

Also a varied film program throughout the evening:

Audubon (His life and travels); The Loon's Necklace; Gorgosaurus; Apollo 11; lantern slides; natural history tours sponsored by Field Museum

And these extras:

A treasure hunt; entertainment in Stanley Field Hall

Photo by Fred Huysmans

THAR SHE BLOWS! Alice and Matthew Orr watch model volcano as it erupts on schedule.

"Dear Mr. Curator: I have a problem. Do monkeys have chins?"

Every third grade pupil in Room 3-E, Tinley Heights School, Tinley Heights, Illinois, has that problem, and all want an answer. Each one wrote his question on a sheet of lined school paper, and class teacher, Mrs. D. Walter, sealed all the sheets in one big manilla envelope, and mailed them to me.

The first letter is a bit vague, but urgent nonetheless.

Dear Mr. Curator
We have a proman. Da
you know if mankeys
have a chin? If they da
will you tell me?
from
Dwayne

The next letter throws more light on the turmoil in Tinley Heights.

Dear Mr. Curator
Da mankeys have
chins. Thats what I
want to know. We saw
a movie. It was called
the whamen animal.
Are we the only anes
that has chins?
Your freind
Steven M.

And this one reveals a mysterious female in the case.

Dear Mr. Curator
We are wanting to
know if monkeys have
chins. A girl in our
class has two monkeys.
Her name is Jackie.
Your friend
Crystal

Kristi goes Crystal one better and makes all clear.

We saw a movie about
animals. It says
mankeys don't have
chins. But I want to
know if they do. Or if
some kinds of monkeys
do. A girl in my room
has some and said they
have chins. So please
tell if all or some
monkeys have chins.
Thank you
Kristi Bistersky

And Gilbert gives us the inside story on how this search for truth started.

Dear Mr. Curator
Our class doesn't
know if a monkey has
a chin. The movie said
animals don't have
chins. But our teacher
asked Jacki in class
that has a monkey if
it has a chin. She said
yes it does. Will you
write to us and tell
us if a monkey has
a chin.
From
Gilbert Dy

Other children like Ann Hayward, Billy Pirman, and Gina Tolva, are just as anxious to know, but Joel broadens the issue.

Dear Mr. Curator
Da Garillas and monkey
and Chimpanza have
chins?

And my good friend Robert goes right to the fountainhead.

Dear Mr. Curator
I want to know if the
monkey has a chin.
Snice you know all
about animals. Their
is a kid name Jackie
has two monkys but
she doesn't [know]
so much that you do.
Your freind
Robert Tagliali

This faith in the superior knowledge and wisdom of Mr. Curator is solidly backed by classmates Craig Cooper, Lauri Edwards, Barry Kline, Sherry Miller, Kevin Schultz, Barbara Schutzius, and just plain Tom. Last, but certainly foremost, our charming and disarming little friend Jackie herself, writes:

Dear Mr. Curator
I have two monkeys
at home. Da they have
chins Mr. Curator. I
saw a movie. They say
that mankeys don't
have chins.
Your friend
Jackie Pedig

the decorative chin

by Philip Hershkovitz
Research Curator, Mammals

Jackie Pedig, age 8, with Susie and Sammy, squirrel monkeys

Yes, Jackie. Your monkeys, indeed all monkeys, and chimpanzees and gorillas, too, have chins. Here is what Webster's Third New International Dictionary of the English Language, Unabridged, has to say about CHIN. "1 : the lower portion of the face lying below the lower lip and including the prominence of the lower jaw and the overlying soft tissues. 2 : the surface lying beneath the lower jaw or between the branches of the jaw—used chiefly of lower vertebrates in which a mental prominence is lacking from the jaw bone."

By either definition, monkeys have chins—as do all animals with lower jaws. The human chin, however, differs from that of monkeys and all other animals in one respect, at least. It has a bump in front that makes it jut out. This is the mental prominence, or mental protuberance, mentioned in the dictionary's definition. Unfortunately, some writers on human anatomy and evolution, and the producers of the movie seen by the children, fail to distinguish between the chin which is present in all animals with lower jaws, and the mental protuberance which is a *special part* of the human chin. The word "mental" used here is a technical term from the Latin *mentum* meaning chin (or beard). The English word mental referring to the mind or intelligence, derives from the entirely different Latin word *mens*. In this case, it seems, a little mental protrusion causes a great deal of mental confusion.

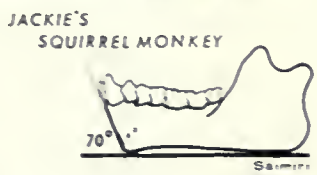
Just how humans came by that mental protuberance, or jutting jaw, is a long, and perhaps still untold story. The ancestor of man, and of all Primates, was a tiny, long-snouted creature no larger than a small mouse. It had separate right and left lower jaw bones which met in a loose joint in front called the symphysis. The front of the joint, or chin, was nearly in line with the base of the jaw. That is to say, the angle of the chin was hardly 10°. Among earliest Primates such as lemurs and tarsiers, the two branches of the lower jaw or mandible remained separate but fitted together into a chin which formed a low but distinct angle with the base line of the mandible. As the different families of monkeys, apes and man began to evolve, the jaw became shorter and its right and left branches fused into a single bone forming a steep chin. All this change was correlated with reduction in length of the ancestral muzzle, the movement of the eyes from the sides of the head to the front, and the use of the hands for bringing food to the mouth. With the changing diet, from mainly insectivorous to mainly herbivorous, the mouth became shorter and more rounded in outline, the number of teeth fewer with less space between, and the chin steeper and broader.

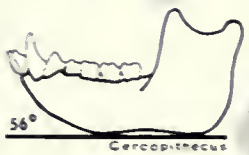
Among the families of New World monkeys, the marmosets are the most primitive, and the angle of their chin averages from 28° in the pygmy marmoset to 49° in Tamarins. In the more advanced marmoset-like *Callimico*, the angle averages 55°, and in squirrel monkeys and ring-tailed monkeys, the angle of the chin averages higher with the extreme nearly 75°. In Old World monkeys like guenons, macaques, and langurs, the angle of the chin is sometimes nearly as high, but in most apes it is higher. In one chimpanzee measured, the angle is 77°, in another it is 80°. In none of these is a distinct mental protuberance present, but a rudiment may appear occasionally in any species of monkey or ape.

The ape-men, or australopithecines, of Africa and Java, lived about 2,000,000 to 750,000 years ago. These earliest of human-like creatures walked erect, and used sticks, stones and bones for tools. Their chins were well formed, verged on the vertical, but lacked a protuberance. The first man, *Homo erectus,* appeared over one-half million years ago in Europe, Asia, and Africa. His chin, as seen in the mandible of Heidelberg man, was strong and angular, but fell even shorter of the vertical than did the chin of some ape-men. In none of these forerunners of man was the jaw receding or "chinless" as generally shown in artistic reconstructions of the face.

The first race of man belonging to our species, *Homo sapiens,* arose between 300,000 and 250,000 years ago, and spread rapidly throughout Asia, Africa

ALL PRIMATES





OLD WORLD MONKEYS

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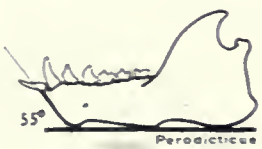
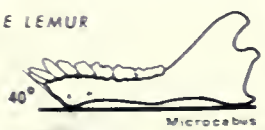
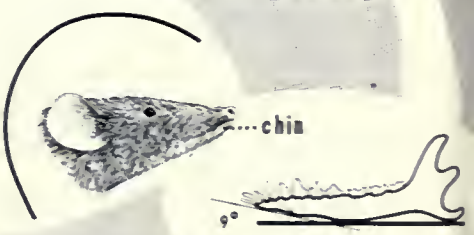
NEW WORLD MONKEYS



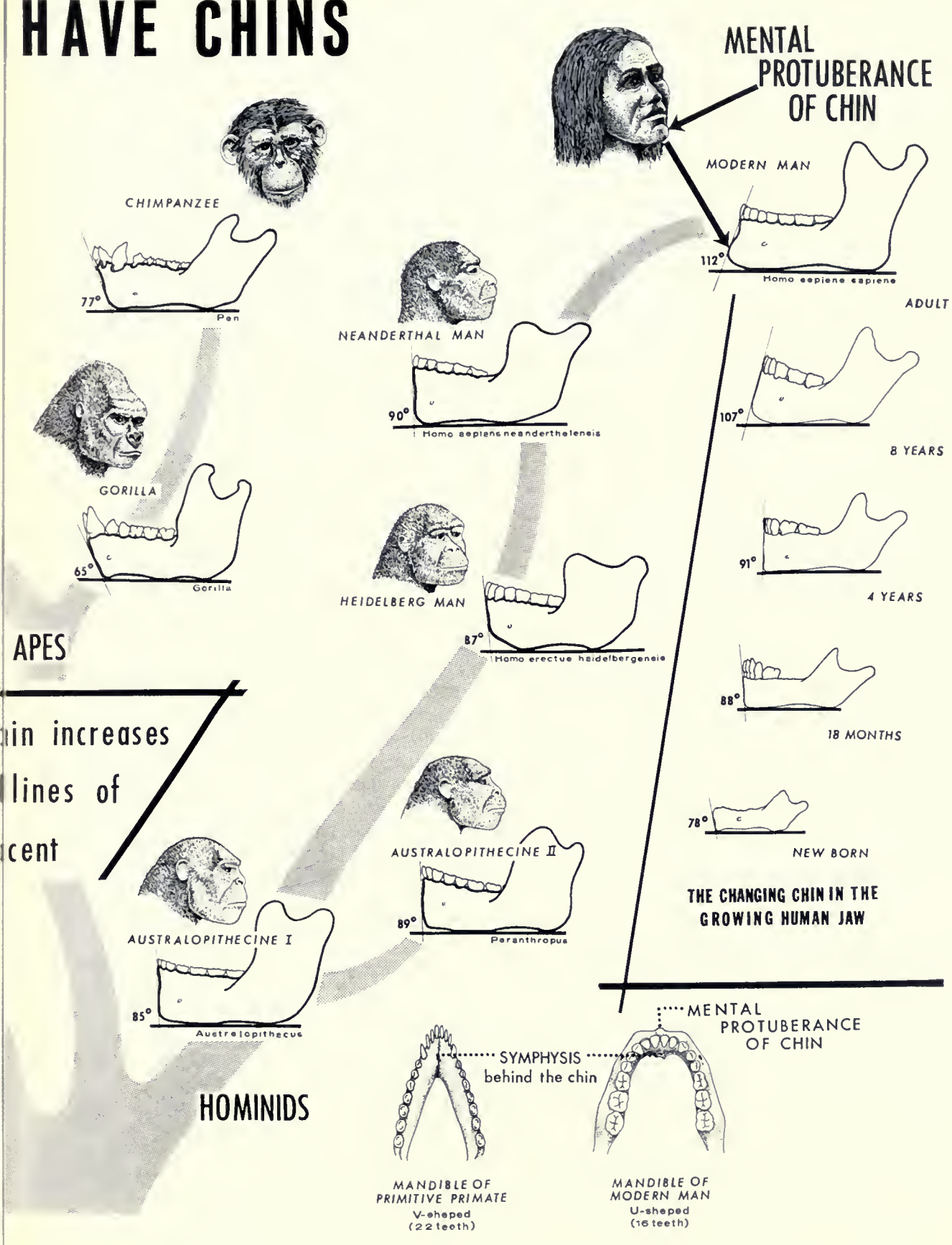




LEMUROIDS

ANCESTRAL PRIMATE

HAVE CHINS



Researched by Philip Hershkovitz for Field Museum of Natural History, Chicago.

decorative chin (continued)

and Europe. The angle of the chin of these Neanderthal types was steeper than that of Heidelberg man, but still less than vertical. In more highly evolved Neanderthals the chin attained, and even surpassed, 90°, and a mental protuberance began to appear as a well-marked feature. However, not until the end of the Pleistocene, and the early part of our own era, between 25,000 and 35,000 years ago, did the jutting jaw with an angle exceeding 90° arise as a distinguishing human character. The back of the human chin, or posterior symphysis, is also peculiar with the broad, bony shelf of most non-human Primates replaced by an everted bony area supporting spines for the attachment of tongue muscles.

The possible function of the mental protuberance has been a favorite subject for speculation. It has been suggested that the protuberance braces the two branches of the lower jaw against the constricting force of the external pterygoid muscles. Early races of man, however, with more powerful muscles, managed to keep their jaws braced without the aid of a protuberance. Furthermore, bony struts, braces, and reinforcements, some known as simian shelves, others as mandibular tori, are extremely variable in structure, and none is consistently present in any one Primate species.

The human chin . . . . differs from that of monkeys . . . . It has a bump in front that makes it jump out.

A noted anatomist argued that the rate of growth and eruption of the teeth caused the alveolar or tooth socket portion of the jaw to be shorter than the basal part, hence the protuberance near the base. There is no evidence, however, that dental growth and succession in modern man differs consistently from that of earlier species of man or even of ape-men, all without the protuberance.

It has been proposed that the shape of the chin is fashioned by the muscles of speech. Such muscles, however, would affect the inner, not the outer, surface of the symphysis. In any case, earliest man inherited all the properties and potentials of speech from his mammalian ancestor, or from an even earlier vertebrate ancestor, as any parrot or myna bird can testify. The significant factors controlling the evolution of rational speech, however, lie in the nervous tissue, and not in the organs of vocalization. *Homo erectus*, judged by what is known of his culture, was certainly a talker. Even the ape-man, *Australopithecus,* must have been capable of speech. Neither of these hominids had our kind of chin. It has also been advanced that fetalization, or the retention of fetal characters in the adult, accounts for the mental protuberance. If anything, the contrary should be true. The chin of the human fetus, newborn, and toddler, is more monkey or ape-like than human.

A good deal has been said about the evolution of the human type of chin as part of the adaptation of the human body to the upright position and bipedal locomotion. There is absolutely no relationship between the two events. Man-like posture and gait had been perfected long before the appearance of the mental protuberance. Furthermore, the poise and movement of the head are controlled by its articulation with the spine, and by the action of neck muscles which have nothing to do with the jaws.

Finally, a distinguished professor of anthropology and author of a textbook, using less prudence than would Tinley Heights third graders, borrowed from a dubious source, the statement that if the human mandible had not changed, it would have constricted the windpipe, larynx, and soft parts of the neck including the vital veins and arteries leading to and from the brain! This dire and fantastic hypothesis ignores the basic fact that growing bone accommodates or yields to the soft tissues which are laid down first. The reverse is never true.

The mental protuberance is a superficial character which arose very late in the evolution of man. It is devoid of any physical function. It evolved in a way and in a place without apparent structural relationship to the mouth or to any other part of the body. The protuberance is, nevertheless, a consistent, distinctive, and very conspicuous human trait. The female chin with its protuberance is bare, smooth, often dimpled, shapes the face, and owns a natural charm and appeal which is rarely if ever altered or heightened by cosmetics. The jutting aggressive chin of the human male must have always been kept bare, by plucking, if necessary, until long after puberty and mating when the beard, if any, would begin to come in full as a sign of senior masculinity. The mental protuberance may be compared with such highly attractive facial features as long head hair, the expansively bare forehead, the raised cheek bones, the variable shape and color of the eyes and lips, and the decorative eyebrows. None of these can claim any biomechanical function. Like them, the mental protuberance appears as a badge of recognition, and as a lure and stimulant to mating. In males, particularly, the pointed chin also accentuates gestures of defiance, and in females, lends eloquence to expressions of haughtiness or petulance. Natural selection favored rapid spread of the mental protuberance until it became universally established as an ornament of the chin unique to modern man. ■

An adult female 17-year cicada. Note the egg slits in the twig made by the ovipositor (which can be seen near the end of the body). The tube-like proboscis through which the cicada sucks sap can be seen on the underside of the head. When there are many egg-slits, the twig may dry up and die.
(Photo by Miss Claire Cotterill)

population explosion— 17-year locust style

by Henry Dybas, Associate Curator of Insects

Seventeen-year periodical cicadas (or '17-year locusts') always attract a lot of popular interest and press coverage when they appear. So it is worth noting that the largest and geographically most extensive brood of 17-year cicadas (Brood X, as it is called by entomologists) is scheduled to appear this year—within a few weeks in fact. As shown on the accompanying map, there are three main areas in Brood X. One is in the southern Appalachians, another is centered in eastern Pennsylvania and Virginia, and the third occupies nearly all of Indiana and the western part of Ohio. Museum members or friends planning a vacation or an automobile trip through any of these areas in late May or June, should take the opportunity along the way to see this spectacular natural phenomenon.

Seventeen-year cicadas are not hard to find in a cicada year. They occur in woodlands and orchards, and the males form large singing choruses that can be heard for some distance on warm afternoons. During the last appearance in the Chicago area, one gas station proprietor, across the highway from a cicada chorus, told me that quite a few drivers coming from the open country to the east, stopped at his station to investigate the noise that seemed to suddenly develop in their cars.

Seventeen-year cicadas are large insects with a wing spread of about three inches and they are conspicuously colored with black body, orange-yellow wings, and bright red eyes. The bizarre red eyes seem to be the feature that most impresses people that have not seen these insects before.

The best place to watch periodical cicadas is in a clearing or along a woodland edge where the foliage comes down to eye-level, and where there is exposure to the afternoon sun. There are a number of kinds of activities like singing, mating, feeding, egg-laying and so on, that can be easily observed. Most of these can be readily photographed because the cicadas are not particularly shy and because they can be incredibly numerous (there may be a hundred thousand per acre, for instance). Males exhibit a characteristic 'sing-fly' behavior. They sit horizontally on a twig and sing one or several song phrases, while the abdomen bobs up and down in time. Then they flutter off and change perches between songs. During the peak of the day, the 'sing-fly' activity can be extraordinarily intense. In one species the thousands of males synchronize their songs, forming one great crescendo of sound. After the sound dies down, the tree-tops seem to explode as thousands of males flutter up together and change positions before they sing again. Drs. Moore and Alexander, of the University of Michigan, have likened this behavior, in one of their technical reports, to a 'gigantic game of musical chairs.' It is an indescribable experience to find oneself in the middle of one of these 'games.'

The life history of these unusual insects has been extensively investigated. The female lays its eggs in slits cut in twigs with its blade-like ovipositor. The eggs hatch in six to seven weeks and the tiny white nymphs launch themselves (like paratroopers) into the air and float to the ground. Each nymph is only about a twelfth of an inch long at this time. It works its way into the soil and attaches to the rootlet of a tree, whose sap it sucks with its beak. For the next 17 years the nymph grows slowly in its solitary underground cell. Early in the 17th year, it constructs a vertical escape tunnel up to near the surface of the ground, sometimes capping it with a turret (much like a crayfish turret). There it waits until some warm night in May or early June when, with thousands of other nymphs, it crawls out of the ground about dusk. Each brown nymph climbs up a nearby tree-trunk or other plant stem, leaving a smooth, round exit hole in the ground about ½ inch in diameter. It fixes itself firmly, the skin splits down the middle, and the soft white adult with red eyes emerges. The wing pads are pumped out by blood pressure and the wings become fully expanded. The body colors and hardens and, the following morning, the adult flies up to the tree-tops. A few days later song is heard and mating and egg-laying begin. Adults live only a few weeks, even if birds and other enemies don't get them, and by late June or early July they are gone for another 17 years. The exit holes and empty nymph skins,

along with browning twigs from egg-slit damage, remain behind as evidence of the emergence.

Essentially, the entire underground population emerges the 17th year within a few weeks time. Normally, only a few stragglers come out the wrong year. A notable exception occurred last year in the Chicago area when many thousands of cicadas, scheduled to emerge in 1973, made a mistake and emerged four years early. Hundreds of Chicago area residents supplied the Museum with critical evidence on this unique event as reported in the August, 1969, BULLETIN (reprints of this article are still available on request). But otherwise the 17-year schedule for all recorded broods has been absolutely rigid. Brood X, for instance, was first recorded in 1715. Two and a half centuries later, on its last appearance in 1953, it was still precisely on its 17-year schedule of emergence.

Our present thinking is that the synchronized appearance above ground of enormous numbers of cicadas after 17 years serves to satiate the birds and other enemies. They can eat only a part of the cicada population before the rest have reproduced and died a natural death. If the same number of cicadas were spread out over a number of years, the reasoning goes, the predators could account for a higher proportion, leaving few for reproduction. Periodicity in cicadas can therefore be regarded as a special strategy that has been evolved, so to speak, to foil predators.

Periodical cicadas have been studied a great deal in the last century—there are hundreds of technical papers written about them. It therefore comes as something of a surprise to discover that some of the most striking things about them escaped detection for most of that time. For example, only in the last ten years has it been firmly established that there are *three* distinct species of 17-year cicadas and not just one. These three species not only have the same 17-year life cycle, but they mostly occur together and, in a given locality, all three invariably emerge above ground the same 17th year. In the South, periodical cicadas have a 13-year life cycle and again all three species occur together and are synchronized on the same emergence pattern.

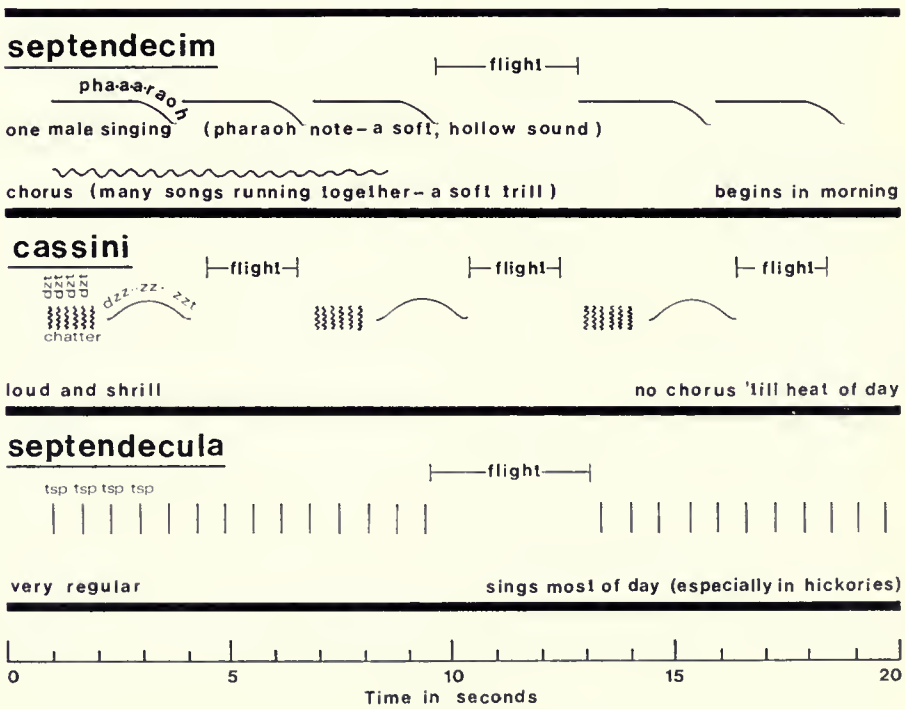
Now that we know that there are three distinct species, some puzzling facts about their ecology and behavior can be clarified. The three species are quite similar in appearance, but one prefers bottomland woods, another occurs on a wide variety of trees in upland forests, and the third species selects upland hickories. The songs of the males are very distinct. Once one is attuned to these differences in song it is possible to go into a woods and identify the kinds present just by hearing them.

It is usually not practical to describe songs in words but the pattern of the three songs is so distinct that, hopefully, the diagram on this page will serve to identify them in the field. Most of the individuals can also be separated on the basis of size and color. Incidentally, females differ from males in having a pointed body behind, with an ovipositor or egg-layer underneath.

The oldest known species is *Magicicada septendecim*, named by the great Swedish naturalist, Carolus Linnaeus in 1758. It is larger than the other species—about 1½ inches long to tip of closed wings, and can be positively identified by the *reddish stripe* between the eye and base of wing. Its belly beneath has yellow cross-banding.

The other two species *lack this stripe* and are smaller, usually about 1¼ inches long to tip of closed wings. One, *Magicicada cassini*, has the belly *dark* underneath or with only traces of pale banding. It is found mostly in lower places along streams. The other, *Magicicada septendecula*, is *yellow banded* underneath. It is usually associated with hickory trees and is almost always much less numerous than the other two species.

With our new knowledge and hindsight about these three species, it is easy to wonder how our predecessors



The three kinds of 17-year cicadas have been confused until a few years ago, but they can be easily recognized in the field by their song. It is the males that sing, and usually only on warm, sunny days. The females are attracted to the trees where the males are chorusing. The song diagrams are also reflected in movements of the abdomen. If one observes a singing male septendecim *in profile, for instance, the abdomen is held high in the beginning of the 'pharaoh' call and dips down when the song ends on a lower pitch. Similarly in* septendecula, *the abdomen dips with each 'tsp,' 'tsp' note. (The diagram is based on the acoustical studies of Drs. Moore and Alexander of the University of Michigan.)*

could have failed to see what is so obvious to us now. The original cicada described by Linnaeus (*septendecim*) was known for a hundred years before the second species, *cassini*, was formally recognized and named. An ornithologist by the name of John Cassin, who was associated with the Philadelphia Academy of Sciences, encountered this second species in Delaware County, Pennsylvania in 1834 (during an emergence of our same Brood X, eight cicada generations ago) and recognized it as distinct from *septendecim*. As a student of birds he was probably able to appreciate song differences, as well as slight color differences between closely related species better than his entomological colleagues of the time. Seventeen years later, when Brood X next appeared, he evidently was able to convince one of the Philadelphia entomologists, who then formally described and named this species *cassini* (in honor of John Cassin, the discoverer). This, by the way, is the species which plays the game of 'musical chairs' in its synchronized choruses. *Cassini* had only a short period of recognition though before being put into limbo. Two famous entomologists of the day, Benjamin Walsh and Charles Valentine Riley, soon became aware that *cassini* (like the long-known *septendecim*) also had a 17-year life cycle and moreover emerged the exact same 17th year with *septendecim* in each and every locality where it occurred. This was too much of a coincidence for Walsh and Riley, so they dismissed the notion that there could be *two* such unusual species and *cassini* became buried and unrecognized for another three-quarters of a century. Since then, several entomologists have independently studied *cassini* (including Dr. Monte Lloyd of the University of Chicago and myself), and it is now clear that it is a perfectly distinct species in song, color, size, structure, ecology, and mating behavior.

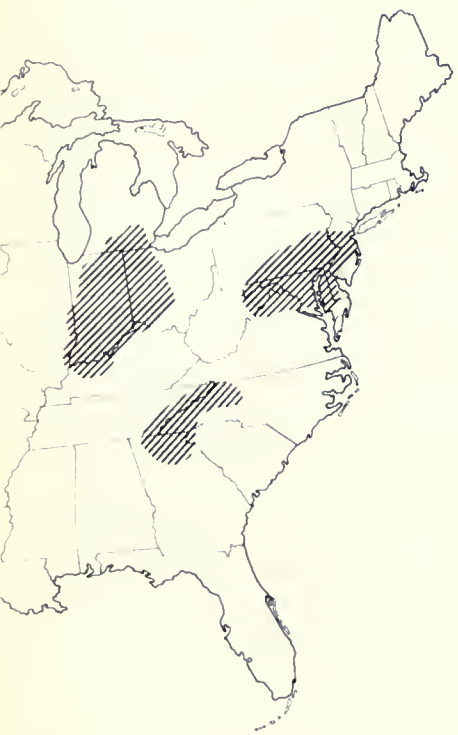
An adult cicada emerging after dark from a nymph skin, which represents the stage in which the ciado lives underground for 17 years. The wings will be expanded and the body will darken and harden by morning when the cicada will fly to the tree-tops. The empty nymph skins remain and are a conspicuous feature of a cicada emergence.

(Photo by D. D. Davis)

The third and longest overlooked 17-year cicada is *septendecula*, described and named only as recently as 1962 by Drs. Moore and Alexander (it appears that every hundred years we discover a new 17-year cicada in our midst). In the years since 1962, it has been found in many different broods and areas from Kansas to Virginia, and in the 13-year populations as well. In spite of its resemblance to *cassini*, its yellow-banded (instead of dark) belly and its very different song should have served to distinguish it. How could such a large, abundant, and widespread species which calls attention to itself by a distinctive song remain unrecognized throughout a century of intensive work on periodical cicadas? It makes one pause and think.

How does one resolve the 'coincidence' problem that troubled Walsh and Riley a century ago? The answer, it appears to us, is that there is an advantage for the three 17-year species to pool their resources and to satiate the birds and other predators with their combined numbers and protoplasm when they emerge the same 17th year, rather than to 'go it alone' on separate years. This, of course, is not a conscious decision but a result of natural selection favoring individuals whose emergence coincided as against those which didn't.

So if you travel and do some 'cicada-watching' in the coming weeks, be aware of the possible complexities of the periodical cicada story as well as of the drama of a great natural spectacle. Possibly the cicadas may still have further surprises in store.



The approximate areas where 17-year cicadas ('locusts') of Brood X are expected to appear above ground in May and June this year. The discontinuous distribution into separate regions is not typical of other broods. The areas in between are occupied by 17-year cicadas that emerge in other years.

Note: The distribution map is based on old records made before the status of the three species of 17-year cicadas was clarified. Therefore we need new distribution information, this time for each of the three species. Hence we will very much appreciate cicada records (exact locality, date, collector, abundance) accompanied by specimens that can be identified as to species.

Preserving Alaska's environment

ANTHROPOLOGY CURATOR TO SERVE ON WATCH DOG COMMITTEE

Dr. James W. VanStone, curator of North American archaeology and ethnology, has been appointed a member of a joint committee of the Arctic Institute of North America and the Bureau of Land Management, Department of the Interior, to advise on environmental protection in conjunction with the projected Trans-Alaska pipeline.

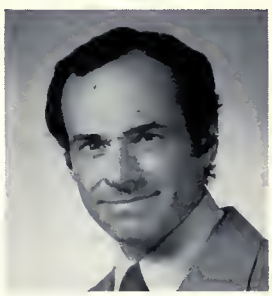
The pipeline, which will serve to pipe oil from Prudhoe Bay on the north coast of Alaska to Valdez, an ice-free port on Prince William Sound, has been of concern to citizens and conservation groups who fear ecological disturbance along the construction route. A permit for the pipeline is expected to be issued soon to the Trans-Alaska Pipeline System, subject to approval by the Bureau of Land Management.

The contractors will be required to hire, among other scientists, archaeologists to survey and preserve archaeological sites according to an agreement to be signed with the Bureau of Land Management. The committee on which Dr. VanStone serves will act as a watch dog group to see that the agreement is carried out.

Dr. VanStone, along with six other northern specialists on the committee, will review the work of the archaeologists hired by the Trans-Alaska Pipeline System and meet three or four times a year with the pipeline and Bureau of Land Management personnel.

An authority on the peoples of the North American arctic and subarctic, Dr. VanStone taught anthropology for eight years at the University of Alaska and seven years at the University of Toronto before joining the Field Museum staff four years ago.

Charles F. Murphy, Jr. ELECTED TRUSTEE



Charles F. Murphy, Jr., the well-known Chicago architect, has been elected a Trustee of the Field Museum of Natural History. Museum President Remick McDowell made the announcement following a recent meeting of the Board of Trustees.

Mr. Murphy is president of C. F. Murphy Associates, Architects-Engineers. Among his many civic and cultural activities, he serves as president of the Graham Foundation for Advanced Studies in the Fine Arts. He is also a director of the Rehabilitation Institute of Chicago, a director of the Tourism Council of Greater Chicago and member of the Mayor's Committee on Chicago Building Code Amendments.

MEXICAN AWARD

Dr. Donald Collier, Field Museum's chief curator of anthropology, receives award from Miss Enriqueta Sanchez of the Mexican Government Tourism Department office in Chicago, as E. Leland Webber, director of Field Museum, looks on.

The citation was in recognition of Dr. Collier's contribution to the success of the Museum's recent Fiesta Mexicana.

to stir the imagination and awaken intellectual curiosity

EDUCATION AT FIELD MUSEUM, 1922-1970

by Donald C. Edinger, Chairman, Department of Education

Field Museum has offered a formal educational program for children since 1922 when a division of education was created.

In 1925 Mrs. James Nelson (Anna Louise) Raymond generously provided an endowment to develop an enlarged and more active program. A Museum publication in 1938 reported:

> "As a result of her benefaction, the eyes of the children are being opened to more of the beauties of the world about them. The great truths revealed in the natural sciences are brought to and impressed upon the minds of the children. An influence has been created which can arouse in them a realization of the broader relationships between man and man, reaching over the bounds of nationality and race; of the relationships between man and beast—the part that animals play in human life; and of the relationships of the plant and mineral kingdoms to each other and to the lives of both men and animals. By this influence it is hoped to stir the imagination of the children, awaken their intellectual curiosity, and spur them on to the development of their latent capacities. The ultimate aim is to lead them into paths which will, when they grow up, make them happier as individuals and more valuable as citizens and members of society."

This viewpoint seems admirably applicable to 1970.

During the years of 1925–38, field trips during school time were added, and innovative educational aids such as Stereoptican slides, 16 mm. motion pictures and sound films were introduced.

By 1938 the Raymond Foundation staff had increased to five full time members. Lecture tours of the Museum and extension lectures in the field were offered to youth groups, schools and universities. These programs, combined with the Saturday entertainment series, reached nearly 240,000 children, a figure that was not duplicated until early in the 1950's.

During the mid 50's the volume of school groups attending the Museum made it necessary to discontinue the extension lectures, as the Raymond Foundation staff was needed for programs within the Museum.

The James Nelson and Anna Louise Raymond Foundation for Public School and Children's Lectures is now part of a newly-formed Department of Education. In 1969 this division, comprised of five full-time lecturers and augmented by a dedicated group of volunteers, served approximately 400,000 children. Between 1971 and 1972 we should reach the half million mark.

The programs are based upon the rich collections on exhibit at the Museum and the educational ingenuity of our staff. In addition to leading scheduled school tours and study groups, the staff is constantly developing and implementing special educational programs.

Through these programs, children are able to use the facilities of the Museum to supplement the information they receive in school and to enrich their knowledge of man's environmental and cultural heritage. This year, for example, a course was offered in African music, using authentic musical instruments. Preparations are being made for a summer course in geology and for programs relating art to natural history. A course in museology is being tested, through which students can explore the role of the Museum and its relevance to society, as well as develop ideas for exhibits.

Ongoing programs are offered in anthropology, biology and earth science. In the summer, 30 selected high school students participate in a program in anthropology, which includes an archaeological dig. The journey program involves the exploration of specific areas of natural history through self-guided tours and has long been a favorite with children.

YOU MEAN IT'S FOR REAL?
First grade students from Irving School, Hammond, Indiana are amazed as Elizabeth Goldring, Raymond Foundation lecturer, shows them the thighbone of a gigantic plant-eating dinosaur on exhibit in Stanley Field Hall. The children are participating in a lecture tour "Animals of the World," one of several tours given to school groups by the Raymond Foundation staff.
(Photo by Ed Jarecki)

CALENDAR OF EVENTS

May hours: 9 a.m. to 6 p.m. daily.

The Museum Library is open to 4:30 p.m. daily.

May 4 Rare Carbonaceous Stone Meteorite. This is the last day to see the latest addition to the Museum's famous meteorite collection. On display in the North Lounge.

May 4 Mexican Jewelry. Featured are silver earrings from the hill villages north of Toluca, Mexico, from a collection donated to the Museum by Mr. F. O. Thompson of Des Moines, Iowa in 1937. Shown in a special display case located on the South Balcony.

May 8 Members' Night, 6 to 10 p.m. Annual spring open house spotlights treasures of the Museum, entertainment, special programs and behind-the-scenes activities.

May 9 John James Audubon's Folio, "The Birds of America," goes on display on the North Balcony. This rare, first-edition copy is the gift of an anonymous donor and is one of the most important acquisitions in the history of Field Museum.

May 9 Latin Day at Field Museum. Special meeting for high school Latin students is sponsored by the Illinois Classical Conference. James Simpson Theatre.

May 23 Illinois by the Sea: A Coal Age Environment, an exhibit of special geological interest opens today in Hall 9. Field Museum scientists collaborated to present this illuminating study of life in this area 300 million years ago. On display to October 25.

May 23 Chicago Area Science Fair. A one-day event sponsored by the Chicago Area Science Teachers Association includes displays of original research projects by students attending private, public and parochial schools in the Chicago area. Awards will be given for the best projects in the areas of study represented, including astronomy, biology, chemistry, geology and general science. Stanley Field Hall.

Through May Spring Journey for Children, "Trees of Illinois," continues to May 31. This free self-directed tour helps youngsters identify various types of local trees. Any child who can read and write is eligible to participate. Journey sheets are available at Museum entrances.

Continuing: 75th Anniversary Exhibit: A Sense of Wonder, A Sense of History, A Sense of Discovery, remains on display in Hall 3 by popular demand. Innovative display techniques are used to explore the past, present and future of Field Museum.

MEETINGS

Chicago Shell Club, May 3, 2 p.m.

Nature Camera Club of Chicago, May 12, 7:45 p.m.

Chicagoland Glider Council, May 12, 8 p.m.

Windy City Grotto, National Speleological Society, May 13, 7:30 p.m.

Illinois Orchid Society, May 17, 2 p.m.

Friends of Our Native Landscape, May 24, 2 p.m.

field museum's natural history tours

gardens
wild flowers
birds
archaeology
congenial travel companions
interpretations by experts
the unhurried approach
travel with all dimensions

EDEN REVISITED: A TOUR OF BRITAIN & ITS GARDENS
May 30-July 4
$2,205 includes $600 donation
Rhododendron & iris time; rose, lily & perennial time
27 historic houses and gardens.
6 plant & bird sanctuaries.
6 archaeological sites.

GUATEMALA LAND OF COLOR & CONTRAST
Oct. 24-Nov. 8
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Gardens at Guatemala City, Antigua, Volcan Fuego, Quezaltenango. Ruins of Tikal, Iximche, Kaminaljuyu. Chichicastenango on All Saints Day. Lake Atitlan.

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Two sections: Dec. 31-Jan. 29, 1971, & Feb. 4-March 5.
$2,807 includes $600 donation.
(22 days of Andes, $2,457; 11 days of Galapagos cruise & Quito, $1,190–separately) Gardens in Bogota, Lima, La Paz, Quito. Ruins of Machu Picchu, Chan Chan, Pachacamac, Cajamarquilla, Ollantaytambo, Cuzco, Lake Titicaca, Tiahuanaco. Spanish Colonial art & architecture in Colombia, Peru, Bolivia and Ecuador.

LEADER ON ALL TOURS, PHIL CLARK, former Editor of Horticulture magazine; former Garden Editor of The News, Mexico; author, "A Guide to Mexican Flora"; Field Museum Natural History Tours Chief; accompanied by Archaeologists specialized in the areas.

All donations to Field Museum are tax deductible.
Rates are from Chicago; may be adjusted from other points.

Write: Field Museum
Natural History Tours
Roosevelt Rd. at Lake Shore Dr.
Chicago, Ill. 60605

BULLETIN
FIELD MUSEUM OF NATURAL HISTORY
Volume 41, Number 6 June 1970

LEAD POLLUTION

New Museums for Old

by Austin L. Rand
Chief Curator, Zoology

RECENTLY, I chanced to read a news story concerning the future role of museums, and a magazine article discussing the "new look" of one specific museum. Together, they illustrate some of the problems that must be faced if museums are to be relevant as well as beautiful. As Field Museum is at the "where are we going?" stage, a critique of these articles is timely.

The news story reported a conference at which some very strong anti-establishment views were expressed. Some were disturbing to me, for example, the opinion that ". . . museums have to be changed or destroyed. . . ." But there was sound sense, too, particularly in the concept of ". . . a museum of the people . . . (which would) reach the inner city." To implement this, it was felt museums should provide ". . . space in central buildings or neighborhood facilities . . . expertise . . . branch museums in inner city . . . (with) no strings attached."

The magazine article dealt with the features of a newly modernized museum: new colors, textures and lighting; specimens rearranged to provide excitement and flowing lines; humorous, cute or poetic labels; mechanical devices to enliven the exhibits. Hardware. Nuts and bolts. These things are necessary, of course, but the real story of the place was in the words ". . . the museum is a bridge between science and conceptual philosophy." Had I not just read the news story, I would have said "Ho-hum" or "So what?" But what I did say was: it is just this sort of "arty" attitude that is being attacked.

Of course, "museum" means different things to different people. My remarks here refer to the public exhibition areas. In them, our aim is to present the kinds of things there are—from precious stones to dinosaurs, rabbits to squid, mummies to Eskimo masks, dutchman's pipes to coconut palms. With such specimens we illustrate the contents of the continents and seas. We show the diversity of life and its processes; how things are different or similar due to origins, habitat or living conditions; and how these things coexist. Among ourselves, we may speak of evolution, systematics, ecology, biogeography and culture. But to introduce these concepts to the public we must use the words and approaches of the market place, the streets and the newspapers.

. . . we must use the words and approaches of the market place, the streets and the newspapers.

Are we using our specimens, words and pictures to tell people what they want to know in ways they can understand? Should we tell them only what they want to know? Many don't realize what can be known. Surely, we can expand their horizons beyond city skylines, and their biological interests beyond humans, rats, roaches and plastic Christmas trees.

But we must start with our audience and their closest environment. Do we know how they want to begin? Should we ask them to help us decide what should be presented on an elemental level as an introduction to the riches beyond? Should we use some of our museum halls for basic statements about the nature of man and his environment? Should we offer help and support without strings for grass roots branch museums by the people, for the people? The ideal answers to these questions may be in conflict with our financial reality. But somehow we must reconcile the two.

Is there not a tide to be taken at its flood? Is not time running out?

MILWAUKEE MUSEUM GETS NEW DIRECTOR

Dr. Kenneth Starr, curator of Asiatic archaeology and ethnology in Field Museum's department of anthropology for the past 17 years, has been appointed Director of the Milwaukee Public Museum. He will take up his new post in the summer.

Dr. Kenneth Starr

Dr. Starr is the fourth curator from the Museum's department of anthropology to be appointed a museum director. The other three are: Alexander Spoehr, former curator of oceanic ethnology, who served as Director of the Bernice P. Bishop Museum, Honolulu from 1953 to 1961; Roland W. Force, former curator of oceanic archaeology and ethnology, who was named Director of the Bernice P. Bishop Museum in 1961 upon Spoehr's appointment as Chancellor of the East–West Center, University of Hawaii; and George I. Quimby, Jr., former curator of North American archaeology and ethnology, who became Director of the Thomas Burke Memorial Washington State Museum in 1968.

E. Leland Webber, Field Museum director, praised Dr. Starr for his great and far-reaching contributions in the field of anthropology. "He has been responsible for large and significant additions to the Museum's Asian collections and for the totally new galleries

(continued on page 14)

Frank Madsen, exhibit designer, prepares exhibit model

Madsen makes final adjustments to shark specimen.
(*Photos by Edmund Jarecki*)

Illinois by the sea: a coal age environment

The story of life in this area 300 million years ago is graphically displayed in a new exhibit, Illinois By the Sea: A Coal Age Environment, which will be shown through October 25 in Hall 9.

Studies by Museum scientists of the Mazon Creek, Illinois, and Mecca, Indiana, vicinities yielded a wealth of fossil material.

Based on 16 years of ongoing research by the Museum's department of geology, the exhibit demonstrates how, during the Pennsylvanian period, these sites bordered the inland sea that occupied most of Illinois. In the Mecca area, the sea inundated the coal forest and during the dry seasons of the following years, the water level was lowered periodically. Animal life became concentrated and trapped in shallow pools. The crowding in some of these pools was extremely severe. The behavior of the sharks is dramatically documented by the fossil remains.

The evidence discovered in the shale are intact pieces of skeletons, and whole skeletons with clearly marked injuries. This led scientists to believe that the creatures ate each other, and that some animals were disgorged in various stages of digestion. In some cases, the sharks could not swallow the prey whole, and they bit off pieces of their victims and let the rest sink to the bottom. Black mud accumulated rapidly, preserving the remains from complete bacterial destruction. The mud firmed up rapidly and, with time, became shale. It is through this shale that the secrets of Mecca were discovered.

Mazon Creek represents the second project presented in the exhibit. About 300 species of animal fossils were discovered, all encased in hard ironstone concretions. The latter preserved many soft-bodied animals in Pit 11 of the Mazon Creek area. Scientists were able to study such animals as bristle worms, Tully monsters, jelly fish, sea cucumbers and the only known fossil lamprey from these concretions.

Dr. Eugene Richardson, curator of fossil invertebrates, writes copy for exhibit specimens.

The Unique Gift of

by Patricia

Snarling saber tooth tigers, charging mastodons, and bloody carcasses encircle a line of enormous skeletons. Although that may sound like something from a Saturday morning kiddie show, it is, in fact, a description of the Museum's Hall 38. This hall has long been a favorite with Museum visitors who delight in the awesome size of the real skeletons of real prehistoric animals on display. After all, most of us get our ideas of the size, shape and habits of dinosaurs and mastodons from B movies.

Remember the movie monster that supposedly slept at the bottom of the sea for millions of years only to be awakened by an atomic blast? The sleep-glutted beast devoured several naval fleets, airplanes and small towns before it was laid to rest. No wonder, then, that people enjoy seeing at least the remains of the real thing. We are preconditioned to be thrilled at the sight of these towering skeletons, and an active imagination can conjure up instant fantasies of action-packed prehistoric life.

If your imagination is a bit on the sluggish side, the 28 murals ringing the 325-foot-long hall will do the job for you. These murals, painted over a period of five years by Charles R. Knight, flesh out the skeletons and depict the long-gone creatures in their natural habitat.

Knight, who died in 1953 at the age of 79, was not a paleontologist, but was one of the world's foremost painters of prehistoric life and numbered many of the great scientists of post-Darwinian time among his friends and associates. He knew Cope and worked with Osborn, Andrews, Ackley, Field, Beebe and many others. Henry Fairfield Osborn, paleontologist and past director of the American Museum of Natural History wrote, "Charles R. Knight is the greatest genius in the line of prehistoric restoration of human and animal life that the science of paleontology has ever known. His work . . . will endure for all time."

Roy Chapman Andrews, another former director of the American Museum, also had high praise for Knight and wrote, "Mr. Knight is a scientist as well as an artist. What he does has truth

Charles R. Knight

I. Williams

behind it. Moreover, he has the faculty of making the animals and early men which he paints and writes about live and become almost companions of our day."

How did he go about it? Although the skeletons give you an idea of size and general structure, they give no clue as to the color of the beast. Did it have fur, feathers, scales or none of these? Was it fat or thin? Lumpy or smooth? Spotted, striped or solid color? Knight's answers to these questions are given in his murals. These murals are not based on fantasy or mere imaginative whimsies, but are the result of years of study and research. In an interview his wife once stated that Knight "did these animals after studying their skeletons; then reconstructing their bodies in clay and placing the models in a setting as nearly correct as science and his imagination could contrive." He didn't then rush through the work of painting the mural. First he made a detailed quarter-sized color sketch and finally, when he felt that it was right, the mural was pronounced completed. He was known, however, to go back to a completed painting to make a correction based on some new fact that he had discovered.

Knight began drawing animals when he was six years old by copying pictures from the dictionary. By nine he was drawing animals from life at the Bronx Zoo. In 1894 when he was 20 years old, Knight was commissioned by the American Museum of Natural History to paint a watercolor of Elotherium, a pig-like animal that lived 30,000,000 years ago. That was the first of many such commissions and today Knight's murals, paintings, bronzes, drawings and lithographs are seen in major museums across the country.

It wasn't just technical accuracy that earned Knight's work such widespread acclaim. Edwin H. Colbert, famous geologist, said, "Knight's restorations of extinct animals are great not only because of his own inherent abilities as an artist, but also because of his readiness to work with scientists . . . his was a constant quest for truth in art and in science." Colbert continued, "He had so much imagination he could project

(*continued on next page*)

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himself back in time and feel that he was on a cliff or in a swamp with one of those monsters."

This sense of empathy was also recalled by Mrs. Richard Steel, Knight's daughter, in a discussion of her father's painting "Snow." The painting depicts three Neanderthal people cowering in a blizzard. According to Mrs. Steel, Knight "would look at his painting, shake his head sadly and, with tears in his eyes, he would say 'Poor little devils. They had such a hard time.'"

He was right. The era depicted so often by Knight must have been filled with hardship, violence and sudden death; and still Knight's murals here at Field Museum are not gruesome or chilling. As Lothar Witteborg, Chief of Exhibition, says, "The murals are soft, sensitive and yet they also project a certain vitality."

This "certain vitality" and skill was not limited to depicting prehistoric life. In addition to illustrating literally hundreds of textbooks, scientific books for laymen, monographs and articles in magazines and newspapers, Knight himself wrote articles and four books—*Animal Drawing*, *Life Through the Ages*, *Before the Dawn of History* and *Prehistoric Man, the Great Adventurer*.

Just as he worked in many media, Knight also covered many subjects. His pencil drawings of animals are quite remarkable and bear graphic witness to his knowledge of animal bone structure and musculature. He was most fascinated by the cat family and once wrote, "Put the lion at one side and all the others, including the tiger, in an opposite category." In the section on the Feline Group in his book *Animal Drawing*, Knight wrote, "Closer study of the splendid creatures of the plains and forest can only fill us with enthusiasm and zest for a still greater knowledge concerning all living things with their application to art in its multiple phases."

Despite his enthusiasm for the lion, his painting of the American buffalo was one of his greatest successes. Painted for the U. S. Treasury, this example of Knight's fine work was used on the $10 bill and a 30c stamp. It is also used as a trademark by an insurance company and is the official symbol of a town in Wyoming.

In 1938 George Grey Barnard, American sculptor and collector, wrote to the editor of *Natural History Magazine*, "I wonder if you and your readers realize the unique gift our country possesses in the genius of Charles Knight. No one living can draw animal life as he does. He has wrought life and line together. The force of his drawing comes from the knowledge he possesses of animal life."

Like other art museums before it, the Peoria Art Museum recently held an exhibition of 98 of Knight's works. Why not, next time you are strolling through Hall 38, consider the murals displayed there as an exclusive showing of some of the finest work of its kind in the country and appreciate them as the "unique gift" that they are? ■

Journey Program stimulates students' interest, provides world perspective

by George Fricke
Lecturer, Raymond Foundation

Field Museum is an awe-inspiring place. With three floors of exhibits covering subjects from Stone Age man to the moon, it simply cannot be explored in one day. Yet, there is so much that can be learned if one only knows where to begin. The Raymond Foundation, a part of the Museum's Education Department, developed the Museum Journey Program to give children a starting place for their visit to the Museum and to provide a guide which would help them learn from the exhibits.

Journeys are self-guided tours which take boys and girls to exhibits illustrating a particular phase of natural history. They contain information about this subject and questions for the visitor to answer. Four Journeys are offered each year. The first Journey, "Drums," was taken by 80 youngsters in the spring of 1955. Subsequent Journeys attracted more and more children, and the Raymond Foundation staff noticed that some of the same boys and girls were taking each succeeding Journey. They felt that these youngsters deserved recognition for their accomplishments and, in the spring of 1956, 13 boys and girls were invited to attend an award ceremony. The success of the program is evidenced by the fact that this spring, 227 children were invited to receive congratulations and recognition for their work in the Museum.

Children who earned an award continued to take the Journeys and to broaden their knowledge of natural history. So, over the years, various award categories were initiated. After completing four Journeys, a youngster receives the Museum Traveler Award. Continued participation in the program enables him to earn intermediate awards until, after four years of work and 16 Journeys, the youngster becomes a Museum Beagler. Each Beagler receives a copy of Charles Darwin's *Voyage of the Beagle* and a special Journey highlighting some of the things Darwin saw on his famous journey. When this Journey is completed, the young man or woman becomes a member of the Museum Discoverers' Club.

Club members have privileges that are similar to that of an annual Museum membership, until they reach the age of 18. Since the Club began in the fall of 1959, 198 boys and girls have become Museum Discoverers. They are a select group. Each year, approximately 1,200 children turn in a Journey for credit; about 220 receive an award. However, only a handful become Discoverers. Members of the Discoverers' Club have taken full advantage of the Journey Program and have evidenced an early and sustained interest in natural history.

Several past members of the club were inspired by the program to study some aspect of the natural sciences. Ronald Bonneau, who hopes to do graduate work in marine biology, believes that the Journeys helped him gain an appreciation for the natural outdoors and encouraged his interest in wildlife preservation. For Herbert Nipson, a Princeton University biology major, the program stimulated an interest in living things. David Janus feels he gained an interest in the natural sciences leading to his choice of botany as a major field of study. He has been a Shinner Scholar in the Museum's Botany Department.

Of course, not all children who take the Journeys turn them in for credit. Thousands take the sheets home as a souvenir of their visit to the Museum. Classes often take a Journey as a group and discuss their results in school, and Scout groups have incorporated the program into their own award system.

Many parents have made the Journey Program a family project and bring their children to each succeeding Journey.

The Journey Program is growing and spreading. More children take Journeys every year, and many adults have thanked us for the knowledge they gained while taking a Journey with the youngsters. Inquiries about the program have come from museums as far away as Sydney, Australia, and many museums have begun a similar self-guided tour of their own. At a time when knowledge of our environment is so important, the Journey Program has proved itself of value in helping Museum visitors to gain a real perspective of the world around them.

west african art & music

summer journey

8,495

a new high
for
members' night
may 8, 1970

photos by
Raymond Burley
and
Fred Huysmans

Geochemistry - a study of airborne lead pollution

by Edward Olsen,
Curator of Mineralogy

Among the several major branches of the geological sciences the one called *geochemistry* is perhaps the most rapidly growing. The word itself means *chemistry of the earth,* and since the earth consists entirely of chemical combinations of elements into liquids, gases, solid minerals, and biological forms there is very little it doesn't cover. It overlaps such divers disciplines as mineralogy, petrology, petroleum geology, and economic ore geology; and is currently pushing into subject matter traditionally considered the reserve of paleontology.

Traditionally geochemists have considered such problems as where various chemical elements are situated in the internal make-up of the earth. In more recent years they have become more and more concerned with the chemistry of the earth's exterior as well: the dissolved and suspended chemicals in the oceans, lakes, and ground waters; chemistry of the atmosphere; chemistry of soils; chemistry of the ice caps.

Because of current interest in the polar regions more and more data have been gathered concerning them. Probably one of the most interesting and disturbing of recent arctic geochemical studies has been the work of the geochemist, Dr. Claire Patterson of the California Institute of Technology.

In Chicago . . . in 1968 auto fuels generated about 2¾ tons of lead per square mile!

In making borings into the Greenland ice it is possible to see each year's accumulation of new snow by the banding that occurs. Thus, by boring out a column one can tell the year in which a given layer was deposited by counting backward, layer by layer, from the present year. The ice for each layer can next be sliced out, melted, and analyses made for the chemicals contained in it. Dr. Patterson has examined a number of such samples and his findings with respect to their year-by-year content of the element *lead* are remarkable. In the graph (Fig. 1) we see the lead content in northwestern Greenland ice plotted against year from 800 B.C. to the present.

The first question that arises is: From where do these small amounts of lead originate? Besides lead, analyses were made for other elements —sodium, magnesium, silicon, etc. Some of these are due to sea salts blown inland from the nearby North Atlantic; some are due to clay dusts blown in from adjacent unglaciated land and islands. Lead, however, is not a significant constituent in any of these sources. It has been known for a long time that there are large rotating systems of air that rise in equatorial regions, and because of the high solar heat levels there, move towards the poles at high altitudes. Then by cooling off they fall slowly to low altitudes and break into systems of surface weather patterns and move slowly southward again. On their way northward any warm rising air can add itself to this giant air movement and be carried poleward also.

Large urban areas are areas of rising warm air due to the heat output from the many sources of energy that men utilize in heating, making electricity, transportation, and normal human activity. Thus, some of the many gases and dust particles that arise from populous areas are added to these poleward moving air masses and portions of them are carried all the way to the arctic regions where some fall out with snows and rains and become incorporated into the seas, and icecaps. Thus the yearly icecap accumulations can act as a sort of natural sample collection system which can show *relative* changes over periods of historic time.

Mankind has been extracting and using lead since about 2500 B.C. It was about the mid 18th century when industrialization began to grow. This growth was steady with western-world population increases, and demand grew for more kinds of products made of metals, of which lead is a significant one. It is utilized in ceramic glazes, paints, machine bearings, insecticides, fungicides, alloys of many kinds, ammunition, solders, plumbing fixtures, and indirectly in photography and coinage systems. As demand grew more lead has been mined and smelted from its ores. Because lead is easily vaporized in any process that heats it, such as smelting, a certain amount

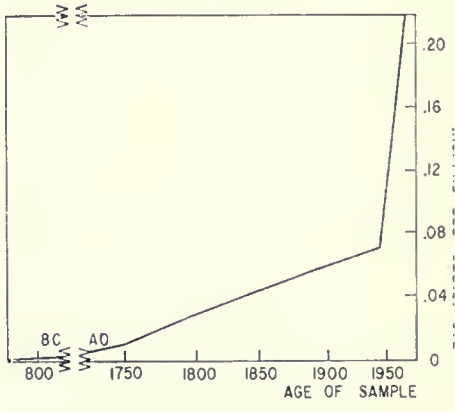

FIGURE 1. *Lead (in parts per billion) in snow from Century Camp, northwestern Greenland, from* 800 B.C. *to the present. For the sake of compactness there is a break in the graph from about* 750 B.C. *to* 1725 A.D. *The lead content over that gap is almost zero.*

goes up the smelter chimneys, is added to the air, falls in adjacent areas with, however, a little of it being carried aloft and ending up in northern snows. The graph in Figure 1 reveals this steady increase in utilization of lead; around 1750 it shows an upward change in slope. The graph, in addition, shows a dramatic feature. In the late 1940's there is a sudden upward spurt in lead in these ice samples. In less than 20 years it increased by 300%!

It was in the late 1940's that automotive manufacturers began building cars with higher and higher horsepower. Gasoline engine horsepower can be increased in two ways: one way is to increase what is called the compression ratio; the other way is to increase the size of the engine. The manufacturers have done both. To obtain the best efficiency from such engines it is necessary to operate them on fuels that have high octane ratings. We will not go into the meaning of this term here but only point out that the octane rating of a gasoline is a rough measure of how much efficiency one can obtain from a high compression engine. Such engines require gasolines rated near 100 octane. Natural gasoline fractions from petroleum crude oils are about 55 octane. To bring up the rating to the desired level it is necessary to perform some chemical changes on the natural gasoline.

The major change involves a process called *cracking*. By repetitions of this process, plus performing distillations, it is possible to produce 100, or even higher, octane fuels. In 1920 a chemist, Thomas Midgely, made a synthetic metal-organic compound called tetraethyl-lead. It is a chemical combination of the elements lead, carbon, and hydrogen. It was found that addition of less than 1% by volume of this compound to gasoline the octane rating could be raised by as much as fifteen octane points. Tetraethyl-lead was less costly to produce than other means of obtaining the same octane increase. It was natural then that it be added to gasolines in the late 1940's.

. . . from 1920 to 1970 over 5 million tons of lead have been utilized in auto engines in the northern hemisphere. Averaging this over the hemisphere it comes to 120 pounds of lead per square mile!

Gasolines are usually marketed in two forms: so-called "regular," which is around 90 octane, and what is called "premium" (or "high-test" or "ethyl") which is around 100 octane. Both forms contain tetraethyl-lead. Although there are limitations on the amount of tetraethyl-lead that can be added to aircraft fuels, there are no limitations for automotive fuels. In general, auto gasolines contain about 3 cubic centimeters of tetraethyl-lead per gallon. In terms of the actual lead content this amounts to slightly over 3 grams (about one-tenth oz.) of lead per gallon.

When gasoline burns in the engine the tetraethyl-lead decomposes and the lead is released. In order to remove it so that it will not form thick deposits, compounds called ethylene dibromide and ethylene dichloride, are put in the gasoline also. The lead combines with these to form lead bromide and chloride. These, and other lead compounds, come out the exhaust system where they cool in the air, combine with oxygen and moisture, and form several bromine and chlorine acids, and a dust of lead oxide so fine that some of it can be carried along in the air, even as far as the arctic snows.

The pronounced effect of this use of lead on the Greenland snows appears remarkable. The average gasoline automotive vehicle (cars and trucks) runs about 13 miles on a gallon of gas and releases only 3 grams of lead in the process. The great impact lies in the fact that over *103 billion gallons* of such fuel are consumed in the northern hemisphere every year. This generates over 310,000 *tons* of lead. In Figure 2 the graph shows the total of tetraethyl-lead used since 1920. At first its use was small; however, by the late 1940's its annual increase is more and more marked. In total from 1920 to 1970 over 5 million tons of lead have been utilized in auto engines in the northern hemisphere. Averaging this over the hemisphere it comes to 120 pounds of lead per square mile!

Such an average is of course quite high for some low population, rural areas that are not crossed by many roads. On the other hand, it is far too low for city areas. In Chicago, for example, in 1968 auto fuels generated about 2¾ tons of lead per square mile!

The question arises where all this unrecoverable lead goes, besides the relatively small amount that finds its way into the upper atmosphere and then to the arctic. In an area

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such as Chicago, where the output is very high, a great deal of it settles out in the city dust that covers the streets and gets into homes. The black, oily dust of a typical Chicago windowsill has small amounts of lead in it. Most of it, however, is flushed away by prevailing winds into the Lake Michigan water supply and beyond. Rain water carries down a portion of it into the rivers and then to the sea. Ultimately most of this lead ends up in the oceans. Some of this lead, however, is absorbed by all creatures that breathe air, including people

It is well-known that lead is a poison. Public health officials point out that lead poisoning falls into two categories: toxic poisoning and chronic poisoning. Toxic poisoning is the result of extreme exposure to inhaled or ingested lead compounds. It usually results in death. A great deal of medical information is available on toxic lead poisoning. Not so much is definitely known, however, about chronic poisoning, which is due to continued exposure to small amounts of lead. It is known to affect the central nervous system, blood vessels, and intestinal tract, as well as other organs. At present there are no clear data on the effect of long term exposure to small amounts of lead. It is known, however, that lead compounds which are swallowed, either directly from the air or with food and water, are only poorly absorbed by the body. Less than 10% of ingested lead is actually absorbed into the blood stream. In terms of ingested lead man is exposed to it in water supplies, canned

Each year over 250,000 tons of lead are added to the seas to be absorbed by fish and lower forms of life. . . . Addition of known toxic elements to the sea can have effects that last forever.

foods, paints, some dishware, cigarette smoke, most fresh fruits, etc. Unfortunately the lungs are much less discriminating, 25-50% of inhaled lead compounds are absorbed into the blood stream. Inhaled lead seems to be the largest source for it in the human body.

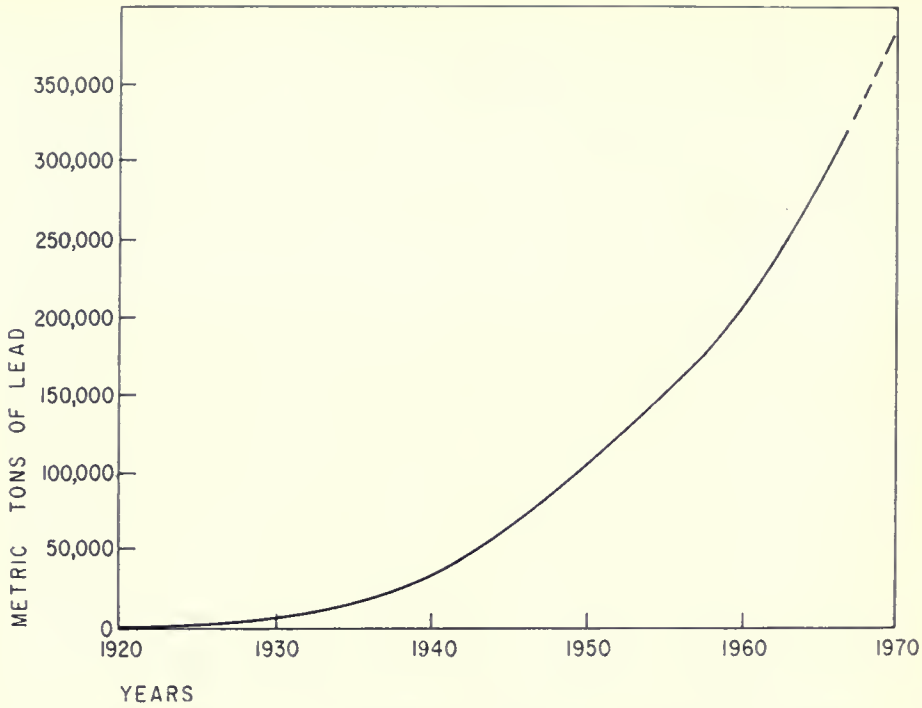

FIGURE 2. *Metric tons of lead (alkyl lead) burned last year in the northern hemisphere, from* 1920 *to* 1970. *The dashed part of the line indicates projection from last data year,* 1966 *to* 1970.

When tetraethyl-lead was originally introduced into auto fuels there were considerably fewer cars, so the problem of adding lead to the air was not considered serious. In addition, it *was* believed that the body had the ability to eliminate lead (below toxic levels) as fast as it was absorbed. As time has gone on, however, the number of cars has increased. We have also learned that lead builds up in the body. The *natural* body content of lead, of a primitive man thousands of years ago, was about 2 milligrams. Today the average in the United States is about 100 milligrams, with some city dwellers running as high as 200 milligrams. About 91% of this is deposited in the bones. The bone content of lead increases with age. This, in itself, means that there is no body balance for lead, that is, it cannot be totally eliminated as it is absorbed, otherwise beyond some certain age everyone older than that would have a similar amount in their bones. Instead it keeps accumulating with age—the older you are the more you have. If you live in an urban area, as most Americans do these days, you are exposed to higher amounts and accumulate it faster.

Because the great majority of Americans live in cities where the exposure to lead in the air is great, a number of recent studies have been made to determine the exposure levels. On the average there is about 1 millionth of a gram of lead per cubic yard of city air as opposed to a *natural* level of about 50 *billionths* per cubic yard. That is, the city air averages about twenty times higher! In a recent study on 45th St. in New York City, the lead content of the air was almost 10 millionths of a gram per cubic yard at street level during rush hours. This is about 200 times higher than *natural* levels. Rural dwellers are exposed to only a fraction of such amounts except, however, in highly agricultural areas during the growing season when crops are sprayed with certain lead compounds that act as fungicides and insecticides.

Because of such agricultural uses on tobacco crops, smokers expose themselves to more inhaled lead than non-smokers.

The effects of such exposures are not certain by any means. Public health and industrial health doctors vary in their view of it. In reality there are no good scientific data giving a measure of the effect on humans. It is known that for many Americans the blood level concentration of lead is about 0.25 parts per million. The threshold for classical lead poisoning is considered to be 0.8 parts per million, and some medical authorities place it at 0.5 parts per million. These numbers are clearly too close together for comfort!

The question arises whether this addition of lead to the air is necessary? Clearly it is not. Reduction of auto horsepower would allow lower octane ratings and tetraethyl-lead could be eliminated. On the other hand, additional refining and chemical changes can make high octane gasoline without tetraethyl-lead. At least one major petroleum company in the eastern United States sells both regular and high-test *unleaded* gasolines of high octane ratings for high compression engines, *and* at competitive prices. Thus, it is not a matter that would greatly increase the cost to the consumer.

Reduction of auto horsepower would allow lower octane ratings and tetraethyl-lead could be eliminated.

Early this year one major auto manufacturer announced that in the 1971-72 period it would begin production of a lower horsepower engine that does not require leaded fuels. Unfortunately this step is being taken for the wrong reason. Anti-smog devices (required on vehicles by many states) become quickly clogged with lead oxide deposits and require frequent cleaning to operate properly. It is for this reason the change is being made.

In any event, numerous public health officials, as well as university researchers, are becoming alarmed by the addition of lead to the air, which goes eventually to the oceans. Each year over 250,000 tons of lead are added to the seas to be absorbed by fish and lower forms of life. Dependence on the sea for food will increase over the next century. In addition, from certain microscopic sea plants comes the bulk of the world's supply of oxygen. Addition of known toxic elements to the sea can have effects that last forever.

With Dr. Patterson's work the field of geochemistry seems to have entered a new area—the area of public health. The dramatic effect which man's use of lead has had on the geochemical record, as seen in Figure 1, is a clear illustration of the fact so often overlooked: we are living in what is called a closed system. Nothing goes "away"—it only goes somewhere else. Lead is only a part of the picture. It is but one element that man is concentrating, utilizing, and allowing to accumulate ultimately in the oceans. Elements such as mercury, bismuth, and tin are significant elements that are less obvious in their use and less understood in their cycles through the biological world.

. . . we are living in what is called a closed system. Nothing goes "away"—it only goes somewhere else. Lead is only a part of the picture. It is but one element that man is concentrating, utilizing, and allowing to accumulate ultimately in the oceans.

If a clear-cut case could be made that lead had no effect on human and other life its use in fuels would never be an issue. With the long-term effects unknown it seems to be folly to continue its use only to learn the effects the hard way. ■

GREENLAND GLACIER ICE

CARM CONFERENCE

42 anthropologists and computer scientists and experts from eight North American and European countries recently met at Field Museum to discuss the need for and the best way of achieving an inventory of ethnological collections of all museums of North America.

The conference, which was called by the Committee on Anthropological Research in Museums (CARM), was organized by Dr. Donald Collier, chief curator of anthropology at Field Museum, and sponsored by the Wenner–Gren Foundation for Anthropological Research, New York. CARM is an official committee of the American Anthropological Association.

The committee decided to have a pilot computer project in a large museum, and Field Museum was recommended as the site for such a program.

Shown at the conference in Field Museum are, from left to right, Dr. Murray Aborn, National Science Foundation; Mrs. Lita Osmundsen, director of research, Wenner–Gren Foundation for Anthropological Research; Dr. William N. Fenton, State University of New York at Albany and chairman of the conference; Dr. Donald Collier (standing), Field Museum; Dr. Fred Eggan, University of Chicago and research associate in the Department of Anthropology of Field Museum; Dr. Edward C. Weiss, National Science Foundation and Jamie Litvak King, National Museum of Anthropology and University of Mexico.

Women's Board Elects President

Mrs. Edward Byron Smith was elected president of the Women's Board of Field Museum at the Board's annual meeting recently. She succeeds Mrs. Hermon Dunlap Smith, president of the Board since its founding in 1966.

As the new president of the Board, Mrs. Smith automatically becomes a Museum Trustee, with full voting privileges.

A charter member of the Women's Board, she has been extremely active in its programs, serving as vice president during the past year.

Among her many other interests, Mrs. Smith also is vice president of the Alliance Francaise of Chicago and board member of the Passavant Hospital. She is also past president of the Lyric Opera Woman's Board and the Chicago Historical Society Guild.

Mrs. Edward Byron Smith

MILWAUKEE MUSEUM

(*continued from page* 2)

on China and Tibet," Webber said.

Prior to joining the Field Museum staff, Dr. Starr served as a graduate assistant in the anthropology department at Peabody Museum of Natural History, Yale University. He has been a lecturer in Asiatic Archaeology and Ethnology at the University of Chicago since 1959.

The author of numerous publications on Asian prehistory, contemporary Chinese culture and Chinese rubbings, Dr. Starr is currently completing a full-length book titled *Black Tigers: A Grammar of Chinese Rubbings.*

As Director of the Milwaukee Public Museum, Dr. Starr succeeds Stephan Borhegyi who was killed in an auto accident in September, 1969.

to study explosive evolution

DR. LIEM RECEIVES GUGGENHEIM FELLOWSHIP

Dr. Karel F. Liem, associate curator of vertebrate anatomy at Field Museum and associate professor of anatomy at the University of Illinois College of Medicine, Chicago, has been named a recipient of a Guggenheim Memorial Foundation Fellowship.

Dr. Liem will use the fellowship to study the evolution of cichlid fishes in Africa's Lake Nyassa and Lake Tanganyika. Leaving for Europe in August, Dr. Liem will spend approximately six months at the British Museum of Natural History, London and an equal amount of time at the Musee Royal de L'Afrique Centrale, Tervuren near Brussels. These two museums possess the largest collections in the world of cichlid fishes.

"Cichlid fishes have undergone explosive evolution in less than one million years in both Lake Nyassa and Lake Tanganyika," Dr. Liem said, "with one ancestral form giving rise to a great variety of descendants. Today," he said, "only the external characters of these fishes have been studied, and the reasons (or evolutionary mechanisms) for the explosive evolution of the species endemic to Lakes Nyassa and Tanganyika is unknown."

Dr. Liem will study the comparative anatomy of the fishes, particularly the feeding mechanisms. "The ancestral form among these cichlid fishes," he said, "was an omnivorous fish or general feeder, while the descendants possess particular specializations in their feeding mechanisms." By way of illustration, he pointed out that some species now swallow their fish whole, some scrape algae from rocks, some crush snails, some eat only scales of other fish and others eat only fish eggs.

Guggenheim Fellowships are traditionally granted to young scholars, scientists and artists based on demonstrated achievement and strong promise for the future.

Dr. Karel Liem

Educated in Indonesia, The Netherlands and the United States, Dr. Liem holds a Ph.D. in zoology from the University of Illinois, Urbana. He has collaborated on or been the author of 20 publications on vertebrate anatomy and is currently a member of the Committee on Latimeria (to study coelacanth) of the National Academy of Science, Washington, D. C.

Flower and plant prints by Henry Evans on display, for sale

"I think that people are looking for quiet art," Henry Evans, noted San Francisco artist said in reference to his own prints of graceful flowers and plants. A collection of 24 of Evans' prints is now on display in Hall 28 of the Museum. They will be on exhibit through August.

For the first time, copies of each of these prints are on sale at the Book Shop. Signed prints are in limited quantities of approximately 100 each, and sell for $20 apiece.

What is most striking about each of the linoleum-block prints is their delicacy, their sensitive design, their amazing clarity of color. The exquisite colors are a product of his own studio. Many of his prints are monochromes,

but he will sometimes use as many as four colors on a single block. Evans uses Japanese hand-made papers and a century-plus-old hand press which is a museum piece in itself.

Only about 100 prints are made from each block, after which it is destroyed.

Also available at the Book Shop is the book "Flowerpot Gardens" by Clyde Robert Bulla, which is elegantly illustrated by Evans.

If you believe, as Henry Evans does, that "Life is traumatic and tense enough without adding violence to the walls," you will find each of Evans' prints aesthetically and serenely pleasing.

CALENDAR OF EVENTS

Hours: *June 1 to 23—9 a.m. to 6 p.m.*

June 24 to September 7:

Monday, Tuesday and Thursday—9 a.m. to 6 p.m.

Wednesday, Friday, Saturday and Sunday—9 a.m. to 8 p.m.

The Museum Library is open to 4:30 p.m. daily.

June 1 Summer Journey for Children begins. The free self-guided tour, "West African Art and Music," enables youngsters to become acquainted with art forms of four West African peoples. All children who can read and write are eligible to participate. Journey sheets can be obtained at Museum entrances.

Through July 6: Mexican Jewelry. Silver earrings from the hill villages north of Toluca, Mexico, are featured in a special exhibit in the South Lounge. They are from a collection donated to the Museum by Mr. F. O. Thompson of Des Moines, Iowa in 1937.

July 7 A Cast of Australopithecus Boisei, a skull found in Olduvai Gorge, Tanzania, by Mary Leakey in 1959, goes on display in the South Lounge.

July 9 Summer Series of Children's Movies. "Islands of the Pacific" at 10 a.m. and 1 p.m. in the James Simpson Theatre. Admission is free.

Through October 25: Illinois by the Sea: A Coal Age Environment, an exhibit of special geological interest in Hall 9. Field Museum scientists collaborated to present this illuminating study of life in this area 300 million years ago.

Continuing: John James Audubon's elephant folio, "The Birds of America," on display in the North Lounge. This rare, first-edition copy is the gift of an anonymous donor and is one of the most important acquistions in the history of Field Museum.

Continuing: 75th Anniversary Exhibit: A Sense of Wonder, A Sense of History, A Sense of Discovery, in Hall 3. Field Museum's past, present and future are explored through the use of innovative display techniques.

MEETINGS

Audubon Society, June 3, 7 p.m.

Nature Camera Club, June 9, 7:45 p.m.

Windy City Grotto, National Speleological Society, June 10, 7:30 p.m.

Chicago Mountaineering Club, June 11, 8 p.m.

Chicago Shell Club, June 14, 2 p.m.

Windy City Grotto, National Speleological Society, July 8, 7:30 p.m.

FIELD MUSEUM
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E. Leland Webber, Director

field museum's natural history tours

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travel with all dimensions

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Gardens at Guatemala City, Antigua, Volcan Fuego, Quezaltenango. Ruins of Tikal, Iximche, Kaminaljuyu. Chichicastenango on All Saints Day. Lake Atitlan.

THE INCA'S EMPIRE
& DARWIN'S GALAPAGOS
Two sections: Dec. 31-Jan. 29, 1971,
& Feb. 4-March 5.
$2,807 includes $600 donation.
(22 days of Andes, $2,457; 11 days of Galapagos cruise & Quito, $1,190—separately) Gardens in Bogota, Lima, La Paz, Quito. Ruins of Machu Picchu, Chan Chan, Pachacamac, Cajamarquilla, Ollantaytambo, Cuzco, Lake Titicaca, Tiahuanaco. Spanish Colonial art & architecture in Colombia, Peru, Bolivia and Ecuador.

LEADER ON ALL TOURS, PHIL CLARK, former Editor of Horticulture magazine; former Garden Editor of The News, Mexico; author, "A Guide to Mexican Flora"; Field Museum Natural History Tours Chief; accompanied by Archaeologists specialized in the areas.

All donations to Field Museum are tax deductible.

Rates are from Chicago; may be adjusted from other points.

Write: Field Museum
Natural History Tours
Roosevelt Rd. at Lake Shore Dr.
Chicago, Ill. 60605

FIELD MUSEUM OF NATURAL HISTORY
BULLETIN
VOL. 41, No. 7 July 1970

FIELD MUSEUM OF NATURAL HISTORY

BULLETIN

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How we got to where we're going

(*the beginnings of american natural history museums*)

LEE PUTNAM

Courtesy New York Historical Society

The American museum is an institution based on the sociability of the American settlers. The colonists formed clubs to fight fires, satisfy gregariousness and, according to Benjamin Franklin, to gain "rest from their wives." Taverns and coffee houses were early established as places to rendezvous for discussions, most often literary or political. During the 18th century, an interest in science was stimulated and spread rapidly. Numerous amateur learning societies sprang up in a fashion resembling spontaneous generation.

Katz & Katz, quoting from a contemporary account, indicates the casual beginnings typical of such societies—in this case, the Philadelphia Academy of Natural Sciences:

> *There were some young persons, however, disposed to study the laws of the creation . . . who were prone to fall into discussions upon natural phenomena. . . . In the evening they met without appointment at such places of common resort as the city afforded for those of their social position . . .* [*One of them was*] *Mr. John Speakman. . . . His* [*apothecary*] *shop . . . became a center of the literary and scientific gossip of the day.*

Mr. Speakman suggested to some of his acquaintances that they have their discussions at stated times and several organizational meetings were held in his home.

The developing academy was on its way but still had to deal with a problem of etiquette:

> . . . *"The gentlemen were reluctant to be continuously indebted to the hospitality of Mr. Speakman"; so two or three sessions were held at Mercer's Cake Shop, known as the "first public establishment at which ice-cream was sold in Philadelphia." But this proved unsatisfactory. The Philadelphia gentlemen were "under the impression that all visiters* [*sic*] *to such houses must in courtesy become customers," and because they feared that the infant society might degenerate into a club of* bon-vivants . . . *more private accommodation was sought."*

Such a self-sacrificing group of scholars was bound to succeed. In just a few years their research and publishing endeavors gained a wide reputation, and the Philadelphia Academy of Natural Sciences consistently attracted the best of the young scholar-naturalists.

The early scientists had little, except their own intellects, with which to work. There were no libraries, few books and no specimen collections. Reflecting the democratic tenor of the young nation, several groups of scholars set about overcoming these shortages by combining their separate resources.

The Charleston Library Society, for instance, was formed by a group interested in studying the natural history of the South Carolina region. They accumulated and shared a number of geological, botanical, zoological and even ethnological specimens. While this communal Cabinet of Curiosities was typical of the times, the Charleston Library Society contributed a radical idea to the American museum movement. In 1773, the objects the Society had collected were put on view for the enjoyment and edification of all people who wished to come see them.

There were some European precedents to this action. England's Ashmolean Museum had opened in 1683 and is usually given the title of "first public museum." Others followed – – the British Museum in 1759 and the Hermitage in 1764, for instance. The Ashmolean was intended as an aid to research and only those who could validate their abilities and prove their need of the collections were admitted. There was a slightly better opportunity to get into the British Museum since it was "open" daily but each prospective visitor had to submit his credentials and apply for permission to enter.

Only after a long delay might he be accepted among the thirty visitors admitted each day. The Hermitage was possibly the most exclusive of all since visitors were required to present themselves in attire suitable for the court of Catherine the Great. In comparison with these restrictions on accessibility, how different the Charleston Library Society policy seems!

Charles Willson Peale, the popular portrait painter, manifested the same sort of democratic desire as the founders of the Charleston Library Society. Peale was dismayed that most people had little chance to view art so, in 1781, he opened a wing of his home to the public. He displayed his paintings of national heroes as well as the work of other American artists and also put in his Exhibition Hall various objects he had collected.

Peale dabbled in "bone-finding" and his major find, which he mounted and displayed, was the "American mammoth"—actually a mastodon. This was the first time that the skeleton of a prehistoric animal was exhibited anywhere and it generated a great deal of attention. Gradually, the nature exhibits overshadowed the artistic displays.

Peale strove to educate as well as exhibit and in this aim illustrated a growing concern of the American museum movement. The Exhibition Hall was organized to demonstrate the rational plan of nature inherent in the Linnaean scheme. His tickets proclaimed: "The Birds and Beasts will teach thee! Admit the Bearer to Peale's Museum, Containing the wonderful works of NATURE and the curious works of ART."

As Peale's collections grew, his home did not, so in 1794 he moved them to larger quarters and happily continued accumulating. By 1802 it

Lee Putnam is Research Librarian in the Field Museum Library.

was necessary to move again, this time to Independence Hall. While in the State House, the collection was the "nearest thing to a National Museum then in existence," and was augmented by some very important specimens, including those from the Lewis and Clark Expedition.

BARNUM'S MUSEUM.
OVER 200.000 CURIOSITIES!
THE ENTIRE COLLECTION OF THE LATE
GORDON CUMMING,
The Great LION SLAYER,
Hippopotamus, Rhinoceros, Giraffes, Elephants,
NUMBERING OVER 3,000 SPECIMENS,
15 Years Hunting in Africa
Miller's National Bronze Portrait Gallery
125 Portraits of
NORTH AMERICAN INDIAN CHIEFS,
A REAL SOUTH AMERICAN ANT-EATER,
A SOUTH AMERICAN SLOTH. Very Rare.
AN AFRICAN VULTURE, THE ADJUTANT,
GOLD & SILVER PHEASANTS.
AUSTRALIAN OPOSSUM & YOUNG
NATIVE AND FOREIGN BIRDS,
WOODROFFE'S BOHEMIAN GLASS BLOWERS,
WILL EXHIBIT A GLASS STEAM ENGINE
MISS ANNA SWAN, NOVA SCOTIA GIANTESS,
The SMALLEST DWARFS in the World,
Gen. GRANT, Jr.,
Master WILLIAM WALLACE,
Major Colvin,
Miss CORA BALLARD,
Mammoth Fat Infant,
A BEAUTIFUL CIRCASSIAN GIRL.
The Grand Aquaria. The Happy Family.
LIVING MONSTER SNAKES
LIVING AFRICAN CROWNED CRANES.
Wax Figures of Noted Personages.
SPLENDID COSMORAMAS.
GEOLOGICAL, CONCHOLOGICAL, and NUMISMATIC COLLECTIONS, SPECIMENS OF NATURAL HISTORY, WAX STATUARY PAINTINGS, HISTORICAL RELICS, Etc
PHOTOGRAPH ART GALLERY.
A RIFLE AND PISTOL GALLERY
Phrenological Examinations and Charts by Prof. Lavingston
The Grand Piano used in the Orchestra of the Establishment, is from the celebrated Manufactory of STEINWAY SONS.

Even after the death of Charles Willson Peale in 1827, the museum flourished . . . for a while. Ironically, its very vitality was also its undoing. A building was constructed to house the museum. It was financed by a loan from the United States Bank. When that institution failed, Peale's collections were divided and sold to pay the claims of the Bank.

During the first part of the 19th century, several collections, begun in the scientific spirit and through didactic motivations, underwent a change in emphasis or suffered a fate similar to Peale's Philadelphia Museum. A good example of the change in emphasis comes from the museum of the Society of Tammany. In 1790, the character of the Society was still determined by its social aims. Having acquired a group of Indian relics and anxious to extend cultural benefits to members of the Society and New Yorkers at large, a display was set up in City Hall. This was just the beginning of a collection which soon contained "all manner of curiosities as well as a substantial menagerie."

Unfortunately, by 1795, politics had taken precedence over culture within the Society. The two leaders in the museum venture – – John Pintard and Gardiner Baker – – found their views irreconcilable, and Pintard, whose interests had been more scholarly, withdrew leaving Baker in sole possession of the collection which continued on display as Baker's American Museum.

In 1801, Edward Savage, an artist and admirer of Peale's Museum, bought the contents of Baker's American Museum from Baker's widow. Savage, following Peale's example, set up a Columbian Gallery of Paintings and hired John Scudder to deal with the natural materials. Scudder seems to have had his share of shrewdness and soon bought out his partner and opened the New American Museum.

The major attraction of the New American Museum was "true-to-life-displays" supplemented by lectures and (more or less) scientific demonstrations. Among other things, visitors could see the first giraffe in this country, electrical experiments, mummies and ventriloquists. The crowds flocked in to the tune of Yankee Doodle and twenty-five cents. Eventually, Scudder's New American Museum was sold to P. T. Barnum and became the basis of Barnum's American Museum.

The queen of such side-show museums, though, may have been the Western Museum of Cincinnati. Its main attraction was the "Regions," a mechanical Hell complete with sound effects and automatons. An advertisement for the Western Museum is straightforward in identifying the main purpose of the museum as pleasure and also indicates the sort of items displayed by Joseph Dorfeuille, Prop., to further this pursuit:

Wend hither, ye members of polished society—
Ye who bright phantoms of pleasure pursue—
To see of strange objects the endless variety,
Monsieur Dorfeuille will expose to your view.

Lo, here is a cabinet of great curiosities
Procured from the Redmen who once were our foes;
Unperished tokens of dire animosities,
Darts, tomahawks, war-cudgels, arrows and bows,

And bone-hooks for fishes and old earthen dishes,
To please him who wishes o'er such things to pore,
Superb wampum-sashes, and mica-slate glasses,
Which doubtless the lasses much valued of yore.

It may not be great poetry, but the appeal must have been irresistible.

By the beginning of the 19th century, a shift in purposes was becoming apparent. Several museums, originally opened to the public because of the social consciousness of the individuals or societies which assembled them, were being operated as profit-making ventures. In them, instruction was less important than entertainment. Such "side-show" museums, increasingly sensational and commercial as they might have been, still had an important lesson to offer their more respectable counterparts.

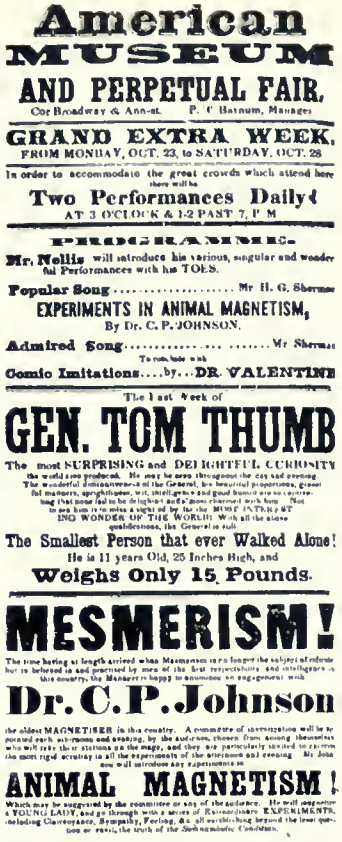
As the institutions of higher learning developed, the disciplines of science and natural theology became more oriented to the academic structure and less a gentleman's avocation. The curatorial staffs of the museum were more often drawn from among the academics than from among the amateurs; concerns of the museums became increasingly esoteric. For the casual visitor confronting rows upon rows of crowded cases, the institutions were earning their reputations as musty, dusty, confusing and forbidding places. The public obviously preferred the "side-show" museums. These made money, and lots of it, while the free museums received relatively few visitors.

Charles Darwin published *On the Origin of Species* in 1859. As natural science turned to the process approach of evolutionary studies the scientists left the museums and went to the laboratories. Having already lost much public interest, museums now began to lose the support of the specialists as well. The museums found it more and more difficult to support themselves. The future existence of many was in doubt.

The solution which developed combined idealism and practicality. The museums changed the basis of their organization. Instead of private ownership by societies, gratuitously allowing public access to their cabinets, museums were incorporated as non-profit public corporations governed by a board of trustees. A three part base of income—from membership, taxes and endowments —was established after the Civil war. Museums which had been in danger of becoming moribund were revitalized as they took up the challenge of justifying themselves as public service institutions.

The American Museum of Natural History provides a good example of the new patterns of organization and their implications for museum directives. Dr. Albert Smith Bickmore, an ardent advocate of Darwinism, was the prime mover in the founding of the American Museum of Natural History. Dr. Bickmore must have been an extremely sagacious and persuasive man. He convinced several powerful people to support his scheme: J. P. Morgan, newspaperman Charles Dana, Theodore Roosevelt and the City Council of New York, among others. The city of New York extended funds for the building and its upkeep while the scientific work was supported by private income.

GENERAL TOM THUMB, 1844
The celebrated American Dwarf, exhibiting every day and evening, at the Egyptian Hall, Piccadilly.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MUSEUM
AND PERPETUAL FAIR,
Cor Broadway & Ann-st. P. T. Barnum, Manager
GRAND EXTRA WEEK,
FROM MONDAY, OCT. 23, to SATURDAY, OCT. 28
In order to accommodate the great crowds which attend here there will be
Two Performances Daily
AT 3 O'CLOCK & 1-2 PAST 7, P. M
PROGRAMME.
Mr. Nellis will introduce his various, singular and wonderful Performances with his TOES.
Popular Song ..... Mr H. G. Sherman
EXPERIMENTS IN ANIMAL MAGNETISM,
By Dr. C. P. JOHNSON.
Admired Song ..... Mr Sherman
To conclude with
Comic Imitations....by...DR. VALENTINE
The last Week of
GEN. TOM THUMB
The most SURPRISING and DELIGHTFUL CURIOSITY
Smallest Person that ever Walked Alone!
He is 11 years Old, 25 Inches High, and
Weighs Only 15 Pounds.
MESMERISM!
Dr. C. P. Johnson
ANIMAL MAGNETISM!

The museum became the interface where the researchers and the public encountered each other. It had gained a wider potential audience but had to arouse and develop their interest. From the beginning, it pioneered in effective exhibit technique to illustrate the new developments in the natural sciences. For example, the cases of specimens arranged according to a "ladder of creation" so prevalent in the other museums of the day, were replaced by habitat groups reflecting the evolutionists' emphasis on the interaction of an organism with its environment.

The American Museum of Natural History was founded in 1869. In the years following, most of the new museums emulated it, although some of the older society museums continued with limited income and pedantic orientation. A stimulus had been delivered and a trend established. Museums such as the Field Museum of Natural History, founded as the Columbian Museum of Chicago in 1893, heralded a new emphasis in museum objectives.

American natural history museums began as private concerns, serving the public on a secondary basis, largely ignoring public interests. The first attempts expressly to attract the public had led to the "side-show" museums which slavishly followed public tastes. As the 19th century drew to a close, museums turned from both alternatives to a constructive, modern program of public service. ■

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The Changing Great Lakes

LOREN P. WOODS

This is the first of a two-part article on the fishes of the Great Lakes. Part II, which will appear in the August issue of the Bulletin, will deal with further changes in the lakes, including pollution, and some of the necessary approaches towards reversing the conditions that are leading to their deterioration.

> "Eastward lies the lake as great a contrast with the city as night with day . . . This half of our horizon is as primaeval as the day white men first entered the region . . . Man has done his bit to the lake, but it is trifling. Shores have changed and Chicago River reversed. The lake remains, however, the one unalterable primitive feature of Chicagoland."
>
> (Harlan Bretz, 1939, *Geology of the Chicago Region.*)

PART I

WHEN this quote was written in 1939, Lake Michigan was much closer to its original condition than it is today. Geologically speaking, Bretz was essentially correct, but ecologically many changes had already taken place, beginning a hundred years earlier and continuing at an accelerated pace to the present. The most rapid and greatest changes in water quality, flora and fauna have occurred during the past 25 years.

The Great Lakes basin occupies only 300,000 square miles, of which about a third, or 95,000 square miles, is water. More than 30 million people live in the basin, and at least 20 million of these people use the water of the Great Lakes. There are more than 300 towns and cities on the shores. Of the total amount of water used from Lake Michigan, 46% goes to industry, 46% to irrigation and 8% to domestic households. For example, *one* steel plant at the south end of Lake Michigan uses one billion gallons of water daily, as much as the entire city of Chicago.

Certainly, the oldest industry on the Great Lakes is fishing. The Indians had developed many types of fishing equipment and in some places, as at Mackinac and Sault Ste. Marie, fishing was the principal means of subsistence of the Indians. In their descriptions, the French explorers expressed amazement at the abundance of fish and the ease with which the Indians took all the fish they could use and trade.

The French—and later the English—fur traders and settlers did little to affect the lakes, and it was not until after 1812 that people began moving in greater numbers into the basin and establishing towns on the shores, mainly at river mouths, that the changes we will discuss began to take place. The large amount of high quality fish in the streams and along the lake shores provided sustenance for many settlements until they were established. But the activties of the settlers started the deterioration of environment which eventually led to the decline, depletion and even extinction of some of the most desirable kinds of fishes. Even so, despite very intensive fishing, the fisheries have held up for 150 years. But there have been many changes.

The first species to go was the Atlantic salmon, which disappeared from Lake Ontario by 1880. Salmon require clear, cool streams in which to spawn. The early settlers altered the streams by cutting timber along the banks and by building dams and mills for power, leading to warming and silting. Repeated attempts to reestablish Atlantic salmon in Lake Ontario have failed.

In Lake Michigan, the first species to be depleted almost to extinction was the lake sturgeon. This occurred during the period of 1840 to 1870 through a process of "cleaning out." Sturgeon were regarded as a pest by fishermen. There was no market for them. Then, in 1870, a market for smoked sturgeon developed, and sturgeon became the object of a very intensive fishery, taking 10,000 to 20,000 fish per year. In 1885, eight million pounds were taken. After this, they declined rapidly. Within 15 years they were so rare in the lake it was no longer profitable to fish for them.

The total amount of fish produced in the United States waters of the Great Lakes fluctuates between 75 to 100 million pounds per year. This amount has remained relatively constant over the past 80 years. The recent changes that have occurred—the invasion of the sea lamprey and alewife—have greatly affected the quantity of the more valuable species.

Until after 1835, conditions in Lake Michigan were primitive, and there was still a great abundance of fish. In 1850, the population of Chicago was 30,000; by 1870, 300,000. The next year, the first survey of the lake conditions and the fisheries was undertaken. Prior to 1850, fishing was largely by gill nets and large

Loren P. Woods is Curator of Fishes in the Department of Zoology at Field Museum. All photos are by the author.

All of the Great Lakes have experienced rapid changes in the past 25 years. The Great Lakes basin occupies 300,000 square miles, of which one-third, or 95,000 square miles, is water. There are at least 20 million people who depend on the Great Lakes' waters.

seines along the shore, principally for whitefish and lake trout. In the 1850's, pound nets came into use, and between 1858 and 1872, fish production was estimated to have decreased by 50%. The decline was blamed on 1) capture of immature fish by pound nets, 2) lost gill nets which continued to fish, 3) the practice of fishermen of cleaning fish in the fishing areas and 4) pollution from sawdust, slabs, sidings, etc. floating widely over the lake, later to sink and cover the spawning grounds.

Until just before World War II, cinders were dumped by lake steamers. Presently, dredgings from the harbors are dumped in the lake. There has also been dumping of garbage and cinders by the barge load by many of the large cities. The only rule restricting this latter practice was that it had to be dumped a number of miles offshore.

But, to return to the 19th Century. Carp were introduced into Illinois in the 1870's and soon spread into Lake Michigan. Their effect was not great, as they lived mostly in shallows and in river mouths. Carp actually became the object of a rather valuable fishery, particularly in Green Bay, where two to five million pounds were taken each year.

During the World's Columbian Exposition in 1893, goldfish and rainbow trout were kept in exposition pools and lagoons as exhibits. Afterwards, these were released or escaped into Lake Michigan. As with the carp, the addition of these had little effect on the lake or its fishes. Large goldfish can still be seen in the weed beds of the various yacht harbors.

Rainbow trout have been reintroduced many times and are well established in clean northern streams of Michigan and Wisconsin, and in many parts of Lake Michigan itself. The descendants of the Exposition stock established themselves in the lake, and for many years a few could be caught offshore around the water intake cribs; but we have heard no reports of rainbow trout in the past 40 years.

The smelt in the Great Lakes, except in Lake Ontario, are all believed to be descended from a successful planting of eggs in 1912 in Crystal Lake, Benzie County, Michigan. It was not until 1918 that the first smelt were noticed in Crystal Lake, and the first large spawning run occurred in 1922. By 1923, they had escaped into Lake Michigan.

Although the smelt became the dominant commercial species through the spring of 1942 (Lake Michigan catch, 14 million pounds), the other kinds of fishes did not seem to suffer, but instead flourished. Then, in the fall of 1942, dead smelt were noticed in Lake Huron off Saginaw Bay and Mackinac. The die-off spread through Lake Michigan, and by the spring spawning season of 1943 few survivors were left.

They began to recover their numbers by 1945, and by 1951 there was again a very heavy run. The smelt population in the 1960's declined somewhat from its former abundance in the early fifties. The reasons for the decline, however, are not clearly known.

The sea lamprey had always lived in Lake Ontario, presumably since glacial times. In 1825, the Welland Canal, by-passing Niagara Falls, was built. In 1921 the first sea lamprey was taken in Lake Erie. So it took the sea lamprey more than 90 years to pass through this barrier. No easy passage—there are seven locks, a 327-foot lift, and 25 miles of length. When the water is let out of the locks, it flows as a torrent; and a lamprey has to have a firm attachment by means of its sucking mouth to the hull of a vessel or the wall of the locks to keep from being washed backwards.

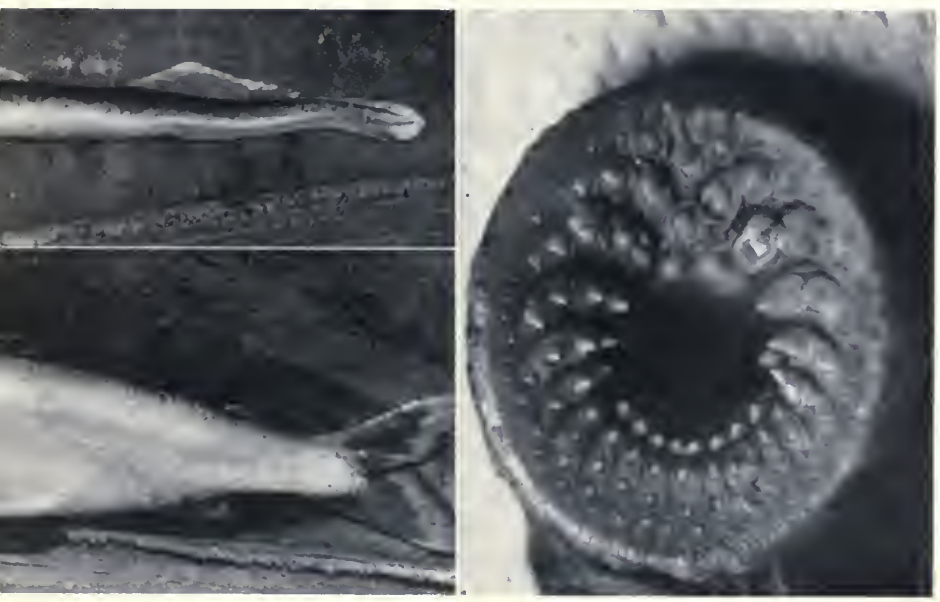
Once in Lake Erie, the lampreys did not do well because of a lack of suitable spawning streams in the Lake Erie drainage. Because of their long life cycle, it was not until 1937

that sea lampreys were established in Lake Huron. Here they found several excellent streams in which to spawn. Lampreys, instinctively, are pretty particular. They like the same kinds of streams as Atlantic salmon; clear, cool and with good gravel beds, not too far upstream from the lake. Sea lamprey spawning runs begin as soon as the temperature of the streams is between 40 and 50 degrees. This usually occurs in late March or April. The migration is usually at night, the lampreys moving upstream until a suitable spawning area of shallow ripples with clean sand and gravel is reached.

After spawning, the adult lampreys die and are washed downstream, where they rapidly decay and disintegrate. The eggs hatch in 10 to 12 days, and the larval lampreys leave the nest 10 to 12 days later. These larvae are carried off the ripples, where, when the current slackens, they burrow into the soft mud and debris that usually collect in such areas of quieter water. Here they live for the next five years, feeding on microscopic organisms and debris sucked from the water passing the mouths of their burrows. During the fifth year, they develop eyes, a sucking mouth bearing horny teeth and the enlarged fins of adults. In the early spring, they emerge from the mud, drift downstream and enter the deep waters of the lake, where they become parasites and feed on the blood of the larger fishes.

Sea lampreys were first noted in Lake Michigan in 1943 and in Lake Superior in 1954. In each lake, it took eight or more years for the lamprey population to build up to a size that serious depredations were noted on the larger commercial fishes, especially lake trout. Many fishes bearing open wounds or scars were taken and these were unsuitable for marketing. Within a year or two the catch began to decline. In Lake Michigan, it fell from a 75-year average of four to six million pounds to less than a few hundred thousand pounds—and then to nothing. Not even young trout were found. The lampreys turned to other large species, especially whitefish and burbot. They preferred lake trout, however, and preyed on them extensively until the lake trout was virtually wiped out by 1951. A similar decline occurred earlier in Lake Huron. In Lake Superior, the catch was 4.5 million pounds in 1951, but six years later, this had decreased to one million pounds. Clearly, the lake trout could maintain themselves as long as man was the only predator, but the additional predation of the sea lamprey was too much, and their numbers were soon reduced to the point of extinction.

The sea lamprey (top) is a predator of many commercial fish. Its victim in the lower photo is a chub. Its sucking mouth bears horny teeth which rasp a hole through its victim's skin. Lamprey saliva contains an anti-coagulant, so the wound stays open while the lamprey sucks the blood and flesh.



Something had to be done to save the fisheries. Several means were obvious to the United States Fish and Wildlife Service personnel studying the problem. The first was to construct mechanized weirs (a dam with a screen across a stream which allows water to pass while catching all fish) near the entrances of the favored lamprey spawning streams. These were devised to block adult lampreys from ascending the streams and to catch larval lampreys from previous spawnings as they descended. Problems with ice, floods and tending to the weirs soon showed such weirs would never be effective. Next, electrical weirs were installed. Here electrodes were lowered into the water, and the electrical field either killed or stopped the adults on their upstream spring migrations. But other fishes were blocked also. Power failures and kills of rainbow trout and white suckers migrating at the same time indicated electric weirs were not the final answer.

Meanwhile, a screening program to find some chemical that would kill lamprey larvae and not other organisms was under way. Nearly 5,000 different chemicals were tested before a very expensive complex compound was discovered that was effective. This could be used in diluted quantities, the effectiveness dependent upon the length of time the poison surrounded the larvae. Electrical weirs were maintained for monitoring purposes. Teams of trained fishery biologists and woodsmen, concentrating on the most heavily infested streams, treated each stream with carefully determined amounts of larvicide. Thus, several generations of sea lamprey were eliminated by a single treatment. In the quantities used, most other fishes were not affected, but more than 95% of the lamprey larvae were

driven out of the mud and killed. Other harmless, non-parasitic lampreys were killed also, as were mud puppies (*Necturus*) and the burrowing mayfly nymphs—a favorite food of rainbow trout. What other changes may have been effected in the streams, and what the long lasting effects were remains undertermined.

The most recent and probably the most devastating invader to the upper lakes has been the alewife—not only to the inhabitants of the lakes, but to those along shore as well. Alewives have been abundant in Lake Ontario for at least 80 years. Just how they got into Lake Ontario —whether they were left there at the close of the last glacial depression of this area; whether they strayed in through the St. Lawrence River (where they do not live now); or whether they were brought in accidentally by man, has not been determined. In the early 1870's, however, shad were introduced into Lake Ontario, and there is the likelihood that alewives were included in the shipment.

For the past 80 years at least, alewives have been a conspicuous nuisance. Nearly every summer large numbers die and, drifting inshore, clutter the beaches—sometimes in such quantities they form wind rows. On occasion, it has been necessary to haul them away.

Since alewives are migratory, running upstream to spawn, they eventually, after nearly 70 years, made it past Niagara, through the Welland Canal, into the upper lakes. They were first recorded in Lake Erie in September 1931. Eighteen months later, one was captured in northern Lake Huron. Although they were now within a few miles of Lake Michigan, they did not enter until 1949. Perhaps they were kept in check by lake trout and burbot that were abundant in Lake Michigan until about this time.

Four years after being first noticed in Lake Michigan, they had spread to all parts of the lake. The first evidence of their spawning was noticed in Green Bay during the summer of 1953. The first large specimen near Chicago was brought to Field Museum in March 1954. In October 1956 the Museum received

young that had hatched the previous summer. The following spring, large numbers appeared floating dead in Burnham Park lagoon and in the harbor north of Shedd Aquarium.

The climax of alewife die-off came in 1967 when the city of Chicago removed 4,500 cubic yards of dead fish from the Chicago shores. This amounted to about six million pounds. Alewives died in all parts of the lake, and it has been estimated that more than 180 million pounds died in this one year. The same year 41 million pounds were harvested by the commercial fishermen. Nearly all of these were three-year old fish. When you consider it takes 10 alewives to make a pound, the numbers assume astronomical proportions, and these are only the three-year olds. The yearlings and two-year olds are yet to be counted. It would appear that alewives are crowding all other fishes out of the lake. The lake herring, emerald shiner, and even perch are much reduced in numbers. Perhaps 90 to 95% of the fishes in Lake Michigan now are alewives.

The question is: Why do they die? The answer is not simple, but it is certainly connected with the fact that alewives are marine fish. Along the Atlantic coast from New England to the Carolinas, they run upstream to spawn, then return to the sea. The young remain in fresh water for a couple of months, then they too move into salt water. In the Great Lakes, alewives are stunted in growth and it would seem that although they can live here, they are not well adapted and so are under constant stress. The cold temperature of the lakes, the changing temperatures, their migration from cold offshore waters into warm, shallow waters, all have been suggested as the cause of death. Another observation has been that when their numbers build up to a peak, die-offs occur. Since the great mortality of 1967, the fish seem to be in better condition, living longer, and though some die, no conspicuous or massive die-offs have occurred.

The best explanation for their death appears to be physiological. In many three-year old fishes examined, the thyroid gland, which functions as a regulatory mechanism of metabolism, excretion, growth and sexual development, appears to have been exhausted. Perhaps this results partly from a lack of iodine in the lake waters and hence in their diet. The stresses of their adopted environment seem to be too much for them.

The managing of a body of water as large as Lake Michigan, along with the many complicating factors discussed here, proves to be difficult. More information is needed on all aspects of the biology and interrelationships of the plants and animals and their environment. We can only hope there is enough time. ■

Tell me everything you know!

PATRICIA M. WILLIAMS

"How can I make a volcano?" "Send me everything you have on cavemen." Every year the Museum's well-earned reputation as a great storehouse of knowledge staffed by an impressive array of experts brings in a flood of such requests. Many of these requests come from students hoping the Museum will supply an instant term paper—"Tell me all about insects. I need this information before May 15"; some come from people who misunderstand the Museum's function—"Dear fossil company, how much are your fossils?" There are always those, of course, with an immediate problem—"I have a bird in my attic. How do I get it out?" "My son was just bitten by a big black bug. What shall I do?"

But many questions also reveal a very real desire for knowledge. After touring the Museum, visitors are often stimulated to learn more about a subject covered only briefly in an exhibit. Perhaps they have discovered a plant or insect in their own backyard that they find unusual, mystifying or even frightening. Whatever the reason, people are thinking about natural history and turn to the Museum for help.

Because Field Museum doesn't maintain a public information service for scientific questions, they are referred directly to the appropriate department—Anthropology, Botany, Geology or Zoology. In most cases, the department secretary passes it on to a curator specializing in the queried field of interest. The curators often answer the questions personally and since even "easy" questions take some research, answers are frequently long in coming.

Despite this, the phones keep ringing and the letters keep coming—with each season, similar questions arise. For example, the Division of Insects can predict that every year in early summer there will be an influx of questions about the attention-getting *Cecropia* moths. Most often, people call in to ask, **"What is the pretty, big moth in my backyard?"** The next most common question about the *Cecropia* is, **"What can we feed it to keep it alive?"** The dismal answer is: "Nothing. These moths do not feed in the adult phase. The caterpillar does all the feeding. There is nothing you can feed it to prolong its life."

While the Division of Insects does not have the personnel needed to answer all inquiries received, Curator Rupert Wenzel and Associate Curator Henry Dybas try to answer as many as possible. Some common inquiries that do receive answers include such questions as: **"Are there any poisonous spiders in the Chicago area?"**

"Yes. The brown recluse spider is poisonous and is established in the Chicago area, and is commonly found in buildings." In fact, Field Museum's Division of Insects identified the first authentic specimen in this area. A physician treating a four-year-old Oak Lawn girl for a spider bite called Dr. Wenzel for information. Dr. Wenzel instructed the doctor to collect spiders from the girl's neighborhood. The physician did so and sent the specimens to the Museum. Mr. Dybas tentatively identified them as brown recluse spiders. After fur-

Patricia M. Williams is Managing Editor of Scientific Publications at Field Museum.

Photo by H. J. Ensenberger

ther study this identification was supported and soon after, a second specimen from Chicago was received.

"My son is interested in insects and I would like to encourage this interest. Can you recommend any living insects for him to keep and observe?"

"The praying mantis is quite interesting to watch. Although it will not respond to you as an individual, it has unusual postures and gestures and really almost looks intelligent. This insect has a short life span, living a couple of months at most.

"An ant colony may also interest your son. Remember, because of state regulations, a queen will not be included in the colony. You must go out and find your own."

"How many different kinds of insects are there in the Chicago area?"

"15,000 to 20,000—and, of course, these insects are in all stages and, therefore, look different at different times."

"When do the monarch butterflies migrate and where are they coming from?"

"They migrate in early fall and pass through Chicago on their way south from Canada, Wisconsin and Michigan."

"How many insects are in the Museum's collection?"

"There are about two million insects in the Museum collections. Obviously, only a minute fraction of these is on exhibit."

"Will the 17-year locust emerge in the Chicago area this year?"

"This will be a big 17-year locust—or cicada—year in many parts of Indiana, Ohio, Pennsylvania, New York and other regions of the eastern United States. Although there was a premature emergence in the Chicago area in 1969, 1973 is the normal cicada year for this area."

Like all divisions of the Zoology Department, the Bird Division receives many inquiries, including: **"Birds keep flying at our picture window. What can we do to prevent this?"**

"The birds are drawn by what is either a mirror image or an apparent opening into your home. In either case, you must destroy this illusion. Of course, you could simply draw the drapes, but this is seldom a satisfactory permanent solution. Dangling tin foil ribbons hung in front of the window is usually effective in dealing with this problem."

"I have often seen bird 'apartment houses' advertised for purple martins. Why do purple martins need a different kind of bird house than other birds?"

"Purple martins prefer communal living—several of them nest together."

"We built what we think is a very nice birdhouse, but apparently the birds don't think so. None have come to live in it. Is there anything we can do to attract birds to this house?"

"No. You'll simply have to be patient and keep hoping. However, if some do take up residence, they will probably return year after year."

In the Botany Department, Chief Curator Louis O. Williams is often asked: **"Is there such a thing as a man-eating plant?"**

Dr. Williams replies, "To the best of my knowledge, there isn't. Stories of such plants are 500 years old and have been propagated by the comics and movies. There are, of course, deadly plants. For example, in the Philippines, natives often refuse to climb trees in areas where a particular nettle plant is found. Men have fallen into these nettles, been stung, swollen up and died."

Although there may not be man-eating plants, there are plant-eating men and sometimes with disastrous results. Last year at Christmas time, Dr. Williams received a call from a loop office, where a lively Christmas party was in progress. It seems that one of the executives had been dared to eat the office poinsettia plant. Bolstered with the season's cheer, he took the dare and quickly devoured the plant. The question was, **"Will a poinsettia hurt him?"**

"Yes. Poinsettias are poisonous." Dr. Williams recommended taking the exec to an emergency room, where the poinsettia could be removed from his system.

One of the country's foremost orchid experts, Dr. Williams reports that people often want to know, **"What kinds of orchids grow in Illinois?"**

"There are several kinds of orchids growing in our state in various areas—bogs, woods or marshes. You can find lady slippers, rein orchids, grass pinks, arathusa, fringed orchids, coral-roots, plaintain, ladies' tresses and calypso."

Ranking with man-eating plants and poisonous spiders in public interest are, as might be expected, mummies, cavemen, Indians and the Tibetan snowman. For instance, every new account of tracks left by the Tibetan snowman brings a predictable tide of inquiries to the Department of Anthropology, most of them asking, **"Is the Tibetan snowman really a man?"**

Dr. Kenneth Starr, curator of Asiatic archaeology and ethnology, replies, "The Tibetan snowman is a long enduring superstition in the Himalayan and Chinese region. In all likelihood, it is not a man, but one of several animals—most probably a bear or antelope."

Recently, the Department received the following request, **"I need a totem pole and wonder if I might borrow one of yours?"** Rather predictably, the writer was told, "We do not have any totem poles that we would

Photo by Ill. State Nat. Hist. Survey

be willing to loan and you may have difficulty in getting any museum to loan poles. If you try to buy one, you will find that they are much more expensive than you perhaps realize. Probably the best bet would be to have one made. There are a number of Indian carvers in the Pacific Northwest who might be willing to do the job. You could probably get the names of such individuals by contacting the Centennial Museum in Vancouver, B. C. However, even this may be more expensive than you are counting on."

An apparently ardent do-it-yourselfer asked, **"How do you make chopped stone arrowheads, scrapers and points like the Indians used?"**

Dr. James VanStone, curator of North American archaeology and ethnology, answered, "There are two basic methods for making these stone tools. The first of these methods is called 'percussion flaking' and essentially this is simply the striking of one stone against another in such a manner as to knock off flakes, which are then used as tools. The other method is called 'pressure flaking' and, as the name implies, small flakes are removed from a stone by means of exerting pressure at some point on the surface, usually with a bone or antler tool. Frequently, both methods are used in the making of a particular tool. The flakes are first removed from a core of rock by means of percussion flaking. Then the implement is retouched or finished by the removal of small flakes by the pressure method. Pressure flaking is very fine work indeed and requires a considerable degree of skill on the part of the craftsman."

Ancient Egypt holds an understandable fascination for many people and questions such as the following are often received, **"Why is there a hole in the ears of several Egyptian funeral masks and statues?"**

"Egyptian children wore earrings until they came of age—between 8 and 10 years old. Earrings were for pierced ears at that time and therefore, most Egyptians had holes in their ears. The Egyptian artists tried to depict the deceased as he had been in life with, generally, a little more dignity in appearance and a formalized stance."

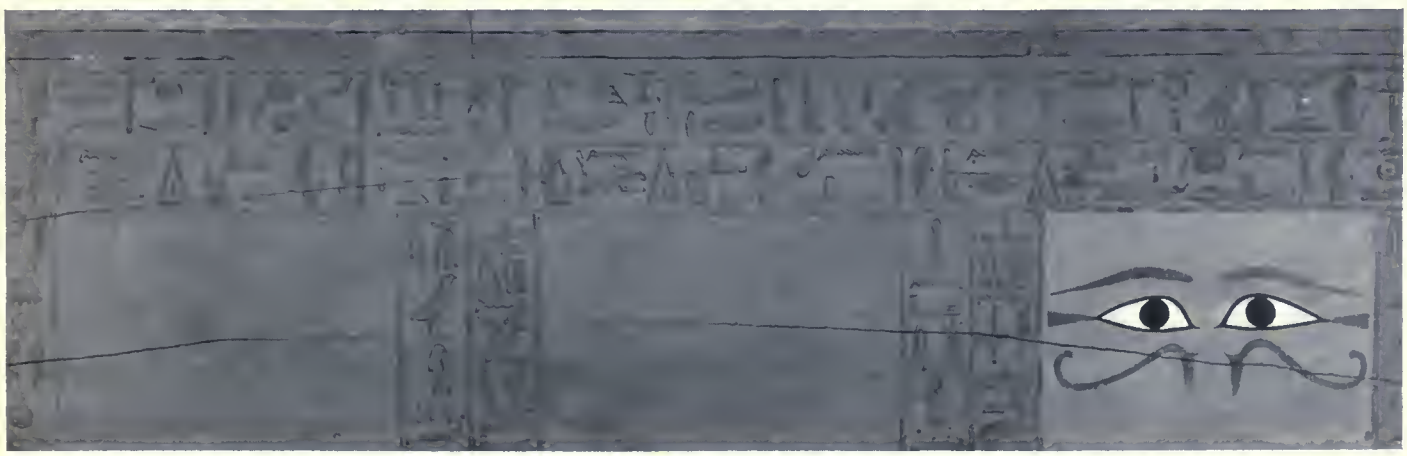
"Do hieroglyphs form an alphabet similar to our 'a, b, c's'?"

"The Egyptians developed an alphabet of 24 letters (sound signs). However, they did not recognize its value and continued to use thousands of ideograms mixed with letters. About 1500 B.C. the Egyptian alphabet was used as a basis for a Semitic alphabetic script—the mother of all modern alphabets."

A high school freshman, who may have been having hair problems of his own, wrote to the Museum to ask, **"How long was caveman's hair? I don't see how they could move because at the age of ten their hair would be at their ankles."**

Dr. Glen H. Cole, assistant curator of prehistory, wrote back, "Soft body parts and hair do not generally preserve, and the cave-dwelling people of Prehistoric Europe weren't given to depicting themselves realistically in their cave paintings, so one doesn't know how long they were inclined to wear their hair. Flint knives, which these people made and used, were very sharp and quite capable of cutting hair. One supposes that they wore their hair at whatever length personal preference and fashion might have dictated."

Again, Dr. Cole was requested to **"Tell me about the height and appearance of man as far back as his-**



tory knows." As Dr. Cole explained, the answer depends upon what is meant by "man." "The Australopithecines, which were living a couple of million years ago, are sometimes regarded as being men. Two forms of these creatures are known—one was about 4 feet tall and probably weighed less than 100 lbs. The other reached as much as 5 feet and weighed perhaps 140 or 150 lbs. The smaller of these creatures (if not both) made stone tools—a criterion often taken as diagnostic in defining "humanness." By the time that the creatures universally regarded as man (i.e., *Homo erectus* with such well-known representatives as Java and Peking man) appeared (about 500,000 years ago) they had reached a size comparable to that of modern man."

Also, a California resident wrote to ask, **"Was it possible for a single man, utilizing only his primitive weapons, to kill one of the larger dinosaurs such as the Tyrannosaurus?"**

While movie-makers and cartoonists do not seem to be aware of this fact, "All dinosaurs, including Tyrannosaurus, had become extinct long before man appeared on the earth. Although man never had an opportunity to exercise his talents for slaughter on any dinosaurs, he quite effectively killed other very large animals—including extinct elephants somewhat larger than the living forms. One can't be sure if a single hunter ever killed any of these animals, but it is reported that certain living people (e.g., the Mguti pygmies of the Congo Basin) kill elephants employing hunting techniques involving a single hunter armed only with a spear."

Naturally, the Museum's Department of Geology also receives numerous letters regarding extinct animals, particularly dinosaurs. The following is typical: **"My friend's aunt has found a dinosaur toe. I would like to know if it really is a dinosaur toe, and if it is what kind. It is 4 inches across and 5 inches long. It's covered with a hardened mud and in this mud are fossils of ferns. As it nears the toe part, it curls up slightly. Where it was broken off the inside is a grayed white."**

She was told, "We will be glad to identify your friend's fossil material as to whether it is from a dinosaur or not. We cannot tell, however, by just one toe what kind of a dinosaur. Send it along to the Museum, care of the Department of Geology, and be sure to wrap it carefully. If you wish it returned, we would appreciate it if you will enclose the necessary postage."

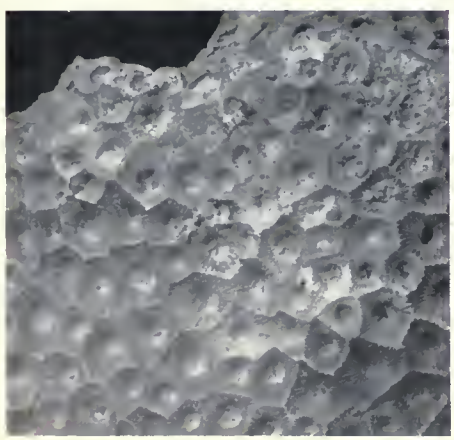
Another girl reported finding **"a rock with a white mark on it. When I cracked it open there was a fossil of a snail. Now I have the cast and the mold. Do you think it is anything worth saving?"**

To encourage young people's interest in natural history, the curator answered, "Yes, indeed here in the Department of Geology we do think what you have found is important. It takes thousands, even millions of years for these rocks to form—this is the only way the earth can leave a record of the plants and animals that lived here long before our time. The Museum has vast collections of all the fossil flora and fauna (plants and animals) which are studied by the research scientists and university students to learn more about the planet we live on. You now have your start for a fossil collection and everywhere you go you can be on the lookout for other fossils. Sometime visit the Museum and look at the geological exhibits here."

Often, entire families are interested in collecting fossils and may ask, **"We would like to spend a Sunday afternoon hunting for fossils. Can you recommend a good spot which is not too far from the Chicago area?"**

"You might try Dresden Lake. A picnic ground on Lorenzo Road about three miles west of Interstate 55 (US 66) just south of the Kankakee River. There is a daily admission fee of 75c. Also, Fossil Rock Campground, about two miles north of Braidwood, just off Illinois 129, is another possibility."

All of the departments frequently direct people desiring information on a grand scale—"I want to know all about the Ice Age"—to their local libraries and bookshops, often recommending appropriate reading material. ■



field briefs

In Memoriam: Delia Akeley Howe

A very remarkable lady, Mrs. Delia Akeley Howe, passed away on May 21, 1970, at Daytona Beach, Florida.

The first wife of Carl Akeley, taxidermist, sculptor and hunter who joined the Museum staff in 1896, her life was closely interwoven with the Museum's early history. A proficient hunter in her own right, she accompanied her husband on several African expeditions. Delia Akeley will be best remembered in Field Museum annals for her participation in the British East African expedition that brought back the now famous "fighting elephants."

Many arduous weeks were spent in the jungle, trekking the elephants and learning their habits. At times, the party was so close to a herd that the slightest move by any one of them, or a shift in the wind, would have alerted the elephants, causing them to bolt in any direction.

The one-tusk elephant was shot by Carl Akeley in the Aberdare Mountains in July, 1906. The following month, his adversary, the large bull with two tusks, was shot by Delia Akeley on Mount Kenya.

The elephants went on display for the first time in 1909 in the Museum's first home in Jackson Park, where they remained until 1920, when the move to the present building began. Since 1921, they have occupied a prominent place in Stanley Field Hall and have become known as the "trademark" of the Museum.

Delia Akeley photographed in Chicago in hunter's gear during the early 1900's prior to leaving on an expedition.

Later, Delia Akeley was to write "J. T., Jr." (N. Y., Macmillan, 1928), the biography of an African monkey that was her almost constant companion for nine years. The book is illustrated with photographs taken by the Akeleys on their safaris. Another book, "Jungle Portraits" (N. Y., Macmillan, 1930), a series of sketches on African life, human and animal, is based on her experiences during several African expeditions.

—Madge Jacobs

new trustee

Blaine J. Yarrington, President of the American Oil Company, has been elected a member of the Board of Trustees of the Field Museum.

Mr. Yarrington has been associated with Standard Oil since 1932. He was elected a director of Standard Oil Company (Indiana), of which American Oil is a subsidiary, in 1970.

Presently he is a director of the Chicago Association of Commerce and Industry and member of the boards of the Chicago Alliance of Businessmen and the National 4-H Service Committee. Mr. Yarrington is on the Business Council of the Chicago Urban League and an honorary life member of the Transportation Association of America. He is also an active member of the American Petroleum Institute.

field briefs

geology gift

The Museum's already extensive geological collection will be expanded by a donation from Gerard Ramon Case of Jersey City, New Jersey. The acquisition consists of a quantity of fossilized sharks and shark relatives, the ratfishes, embedded in black shale. The fossils, dating from the Pennsylvanian Period, were collected in Iowa and Nebraska.

Dr. Rainer Zangerl, chief curator of geology, and Mr. Case will coauthor a paper based on part of this geological collection. After publication of the paper, the entire fossil collection will be donated to the Museum.

grants

The National Science Foundation has granted $41,500 to the Center for Graduate Studies in Systematic Zoology and Paleontology, sponsored by Field Museum in cooperation with the University of Chicago, Northwestern University and University of Illinois at the Medical Center.

The Center makes available the research facilities of the Museum, the scientific staff of the Museum and the faculties of cooperating institutions in the studies of systematic zoology, paleontology, and functional and evolutionary morphology.

• • •

The Museum has received a grant for $19,000 from the National Science Foundation for support of research entitled "Nutrient Utilization in Articulate Brachiopods." The grant, to run approximately one year, will be under the direction of Dr. Helen M. McCammon, research associate, division of lower invertebrates.

HAPPINESS IS . . . a summer lunch on the grass in front of Field Museum. School groups, such as these, were frequent visitors to the Museum throughout the school year.

Photo by Edmund Jarecki.

expeditions

Dr. William Turnbull, associate curator of fossil mammals, is leading an expedition to the Washakie Basin and Sand Wash Basins in southwest Wyoming and northwest Colorado. A part of a research program which has been active since 1956, the expedition is primarily concerned with the collection of early Cenozoic fossil mammals from a mid to late Eocene formation in the Washakie Basin. Dr. Turnbull will also work on stratigraphic correlation of the area. The expedition began on June 15 and will extend through the last week in August.

In cooperation with the United States National Park Service, Dr. John Clark, associate curator of sedimentary petrology, is leading an expedition which started June 29 and continues through August 31 in the Badlands of South Dakota.

field museum's natural history tours

gardens
wild flowers
birds
archaeology
congenial travel companions
interpretations by experts
the unhurried approach
travel with all dimensions

GUATEMALA
LAND OF COLOR & CONTRAST
Oct. 24-Nov. 8
$1,280 includes $400 donation
Gardens at Guatemala City, Antigua, Volcan Fuego, Quezaltenango. Ruins of Tikal, Iximche, Kaminaljuyu. Chichicastenango on All Saints Day. Lake Atitlan.

THE INCA'S EMPIRE
& DARWIN'S GALAPAGOS
Two sections: Dec. 31-Jan. 29, 1971, & Feb. 4-March 5.
$2,807 includes $600 donation.
(22 days of Andes, $2,457; 11 days of Galapagos cruise & Quito, $1,190—separately) Gardens in Bogota, Lima, La Paz, Quito. Ruins of Machu Picchu, Chan Chan, Pachacamac, Cajamarquilla, Ollantaytambo, Cuzco, Lake Titicaca, Tiahuanaco. Spanish Colonial art & architecture in Colombia, Peru, Bolivia and Ecuador.

LEADER ON ALL TOURS, PHIL CLARK, former Editor of Horticulture magazine; former Garden Editor of The News, Mexico; author, "A Guide to Mexican Flora"; Field Museum Natural History Tours Chief; accompanied by Archaeologists specialized in the areas.

All donations to Field Museum are tax deductible.

Rates are from Chicago; may be adjusted from other points.

Write: Field Museum
Natural History Tours
Roosevelt Rd. at Lake Shore Dr.
Chicago, Ill. 60605

calendar

HOURS:

Monday, Tuesday and Thursday
9 a.m. to 6 p.m.

Wednesday, Saturday and Sunday
9 a.m. to 8 p.m.

Friday
9 a.m. to 9 p.m.

The Museum Library is open 9 a.m. to 4:30 p.m. Monday through Friday.

BEGINNING JULY 7:

A Cast of Australopithecus boisei, a skull found in Olduvai Gorge, Tanzania, by Mary Leakey in 1959. Through August 31. South Lounge.

THROUGH AUGUST 31:

Summer Journey for Children, "West African Art and Music." The free program is designed to acquaint youngsters with specific Museum exhibits. Here the art forms of four West African peoples are examined. A question and answer sheet starts any child who can read and write on a self-guided tour. Available at Museum entrances.

CONTINUING:

John James Audubon's elephant folio, "The Birds of America," a recent gift from an anonymous donor. A different page of this rare, first-edition copy is shown each day. North Lounge.

75th Anniversary Exhibit: A Sense of Wonder, A Sense of History, A Sense of Discovery, offers a new perspective in museum viewing through unusual photographic and display techniques. Quotations and relevant observations add another dimension. Hall 3.

FREE SUMMER FILM SERIES FOR CHILDREN

James Simpson Theatre
10 a.m. and 1 p.m.

July 9: "Islands of the Pacific"
July 16: "African Animals"
July 23: "Life in the Arctic"
July 30: "Desert Life"

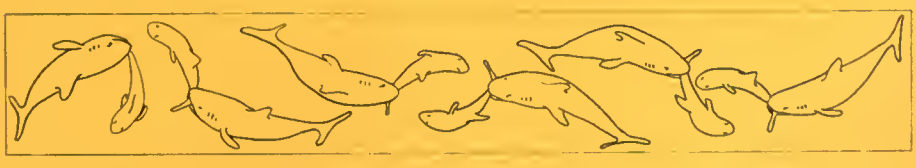
FREE GUIDED TOUR AND FILM PROGRAM

Information desk for tour
Lecture Hall for film

July 6 through September 4

2 p.m.: Museum "highlights" tour

3 p.m.: "Through These Doors." Behind the scenes at Field Museum on film.

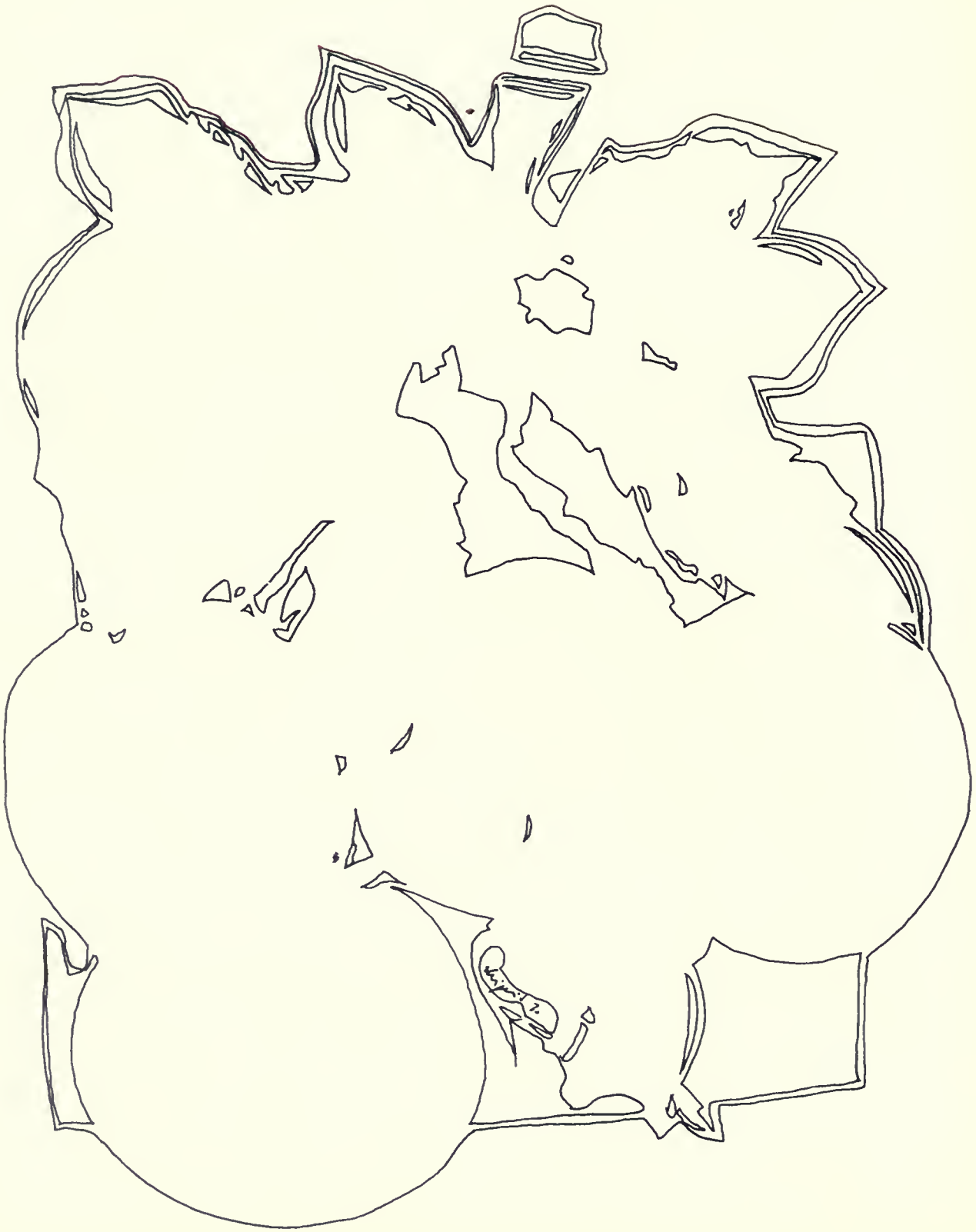


AN EXHIBIT OF SPECIAL INTEREST:

ILLINOIS BY THE SEA: A COAL AGE ENVIRONMENT, through October 25. A study of life in this area 300 million years ago. One segment graphically illustrates how the stress of overcrowding affected the fish population. Hall 9.

FIELD MUSEUM
OF NATURAL HISTORY

BULLETIN
VOL. 41, No. 8 August 1970



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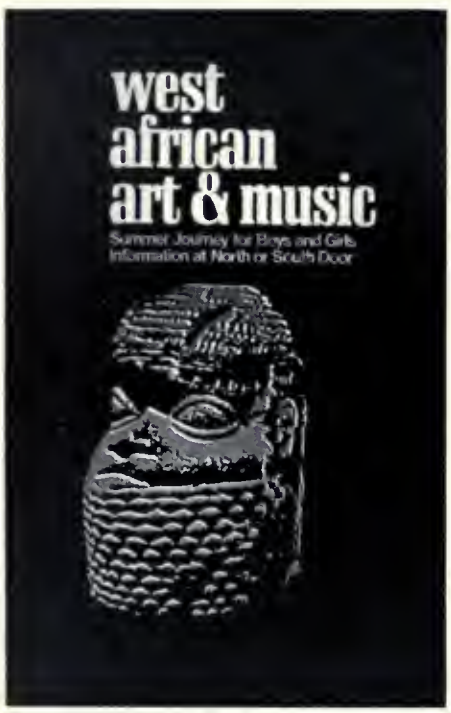

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Field Museum of Natural History
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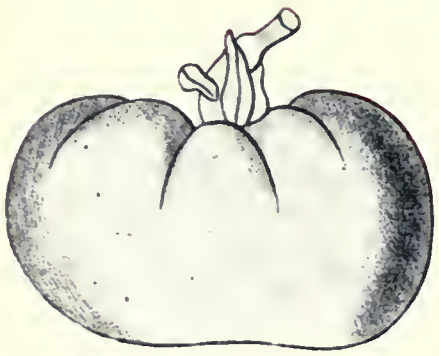
HAPPINESS IS A RIPE LOVE APPLE



W. PEYTON FAWCETT

How little we realize our indebtedness to the great Indian civilizations our forefathers so ruthlessly destroyed! It has been estimated that they developed half or more of the foods we eat today. Try to imagine living, as our pre-conquest ancestors did, without corn (maize), potatoes, sweet potatoes, tomatoes, most types of beans (except the European broad beans and soybeans), capsicum peppers (including cayenne, chili, paprika, pimiento, and the sweet red and green "bell" peppers), many types of edible squash (including pumpkin), cassava (manioc or tapioca), peanuts, cashews, pineapples, avocados, papayas, cacao (source of cocoa and chocolate), and vanilla. Not a very appetizing prospect is it?

Imagine further that, as in the desert island game of book-lovers, tomorrow you would be deprived of all these foods save one. Which would you choose to retain? The choice would obviously be a hard one and arrived at after much soul-searching—probably more than would go into the selection of desert island literature. For myself it would have to be the tomato.

A ripe tomato, eaten raw, is one of the joys of the summer season; it is also excellent, with a simple dressing, as a salad. Consumed in this way, tomatoes are not only tasty but very nutritious, containing, among other food values, significant amounts of vitamins A and C. They can be cooked in numerous ways and are widely used in soups, stews, and sauces. The happy marriage of the tomato and pasta, first brought about by the Italian people, is one of the glories of Italian cookery. The tomato lends itself easily to canning and freezing and is the most widely used canned vegetable. Three quarters of the crop is processed into juice, canned tomatoes, soups, catsup, and tomato pastes.

Although called a vegetable the tomato is technically a fruit. Arthur Hoare, in his article "The Tomato as a National Fruit" (*Journal of the Royal Horticultural Society,* v. 67 (1942), p. 333), describes it as follows: "In botanical language the Tomato belongs to the group of fleshy or succulent fruits, and morphologically its structure is that of a true berry. The Tomato is, in fact, an excellent example of a berry. The fruit, formed by the simple fusion of two carpels, develops, as it ripens, a thick and juicy pericarp. This pericarp is composed of an inner thick mass of tissue of a pale red colour, while on the outside there is a thinner, tougher and deeper coloured layer of tissue, the skin. The ovary cavities are filled with a viscous fluid in which the seeds are imbedded." Despite this, no less a body than the Supreme Court of the United States decided in 1893 that the tomato would be considered a vegetable for purposes of trade because of its common use in the main part of a meal. This fruit now ranks third among our vegetable crops.

Despite its great popularity and long cultivation, the tomato has only within the last century become recognized as a valuable food plant and is consequently one of the newest to be used on a large scale. The history of its rise to prominence is a curious and interesting one.

There is no written record of the date or circumstances of the introduction of the tomato into Europe and considerable speculation as to the precise locality from which it came. It must have been introduced shortly after the Spanish

W. Peyton Fawcett is Head Librarian of Field Museum's Library.

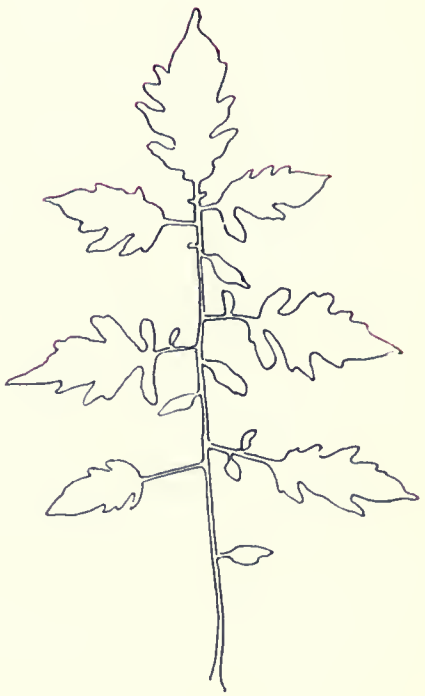
conquest, for the yellow variety is mentioned as early as 1544 and the red known by 1554. It is assumed that the tomato was first cultivated in Europe on the coastal plains of Spain and Portugal and quickly spread to Italy and other countries. The earliest writers did not mention, if they knew, its place of origin and this led to two hypotheses. The first, summed up by L. C. Luckwill in his article "The Evolution of the Cultivated Tomato" (*Journal of the Royal Horticultural Society*, v. 68 (1943), p. 20), is that "the names *Mala peruviana* and *Pomi del Peru* by which the plant was known during the sixteenth and seventeenth centuries seem to indicate that it was from Peru that the plant was introduced into Europe." The second, summed up by J. A. Jenkins in his article "The Origin of the Cultivated Tomato" (*Economic Botany*, v. 2 (1948), p. 379), is that: "The ancestral form of the cultivated tomato was originally confined to the Peru-Ecuador area. After spreading north possibly as a weed in pre-Columbian times it was not extensively domesticated until it reached Mexico, and from there the cultivated forms were disseminated."

The yellow form of the tomato was first described by Matthiolus (Pietro Andrea Mattioli) in his commentary on Dioscorides (1544). J. A. Jenkins, in the article mentioned above, has translated the reference as follows: "Another species [of Mandrake] has been brought to Italy in our time, flattened like the melerose [sort of apple] and segmented, green at first and when ripe of a golden color, which is eaten in the same manner [as the eggplant—fried in oil with salt and pepper, like mushrooms]." In a later Latin edition (1554) Matthiolus mentioned the red form and gave the tomato's common name as *"Pomi d'oro,"* with its Latin equivalent *"Mala aurea,"* for the first time. The name *"Pomi d'oro"* has persisted in Italy as the common name, and it has always amused me to see rich, red plum tomatoes described as "golden apples." These golden apples became associated with the golden apples of the Hesperides and from this source the tomato received another of its many names, *Poma amoris* (apples of love).

To make matters more confusing Luigi Anguillara, in 1561, mistakenly identified the tomato as a plant described in the classical writings of Galen under the name *Lycopersicon* (Wolf peach). From this is derived the modern scientific name of the tomato, *Lycopersicon esculentum.* Our word tomato is derived, according to Jenkins, from the Nahua word *tomatl* through the Spanish *tomate.*

From these early references and others we get the impression that the tomato was considered more of a curiosity than a food plant. Tomatoes were eaten, according to John Gerarde's *The Herball or Generall Historie of Plantes* (1636 edition), "In Spaine and those hot Regions . . . prepared and boiled with pepper, salt, and oyle: but they yeeld very little nourishment to the body, and the same naught and corrupt. Likewise they doe eate the Apples with oile, vinegre and pepper mixed together for sauce to their meat, even as we in these cold countries doe Mustard." But in most areas they were looked upon with a jaundiced eye. The tomato was, after all, a member of the nightshade family (*Solanaceae*) and had been originally described as a species of mandrake. This alone could account for the belief that it was poisonous and possessed aphrodisiac qualities. The name "love apple" helped to reinforce belief in the latter. In addition, the name *Lycopersicon* conjured up visions of Galen's plant, the juice of which had a bad odor, was thought to be poisonous, and at the same time possessed powerful medicinal properties. The shape of the early tomato was also a problem; it was "uneeven and bunched out in manie places," with deep and irregular furrows. To some it looked like a morbid growth and this is responsible, it is thought, for the belief that tomatoes cause cancer.

These false beliefs were very difficult to overcome and up to 1750 the situation was pretty much what it had been. By 1760 some tomatoes were being grown in England for soups; but there is no record of their culture in the United



Poma amoris.
Apples of loue.

¶ *The Place.*

Apples of Loue grow in Spaine, Italie, and ſuch hot Countries, from whence my ſelfe haue receiued ſeeds for my garden, where they doe increaſe and proſper.

¶ *The Time.*

It is ſowne in the beginning of Aprill in a bed of hot horſe-dung, after the maner of muske Melons and ſuch like cold fruits.

¶ *The Names.*

The Apple of Loue is called in Latine *Pomum Aureum*, *Poma Amoris*, and *Lycoperſicum*: of ſome, *Glaucium*: in Engliſh, Apples of Loue, and Golden Apples: in French, *Pommes d'amours*. Howbeit there be other golden Apples whereof the Poëts doe fable, growing in the Gardens of the daughters of *Heſperus*, which a Dragon was appointed to keepe, who, as they fable, was killed by *Hercules*.

¶ *The Temperature.*

The Golden Apple, with the whole herbe it ſelfe is cold, yet not fully ſo cold as Mandrake, after the opinion of *Dodonæus*. But in my iudgement it is very cold, yea perhaps in the higheſt degree of coldneſſe: my reaſon is, becauſe I haue in the hotteſt time of Summer cut away the ſuperfluous branches from the mother root, and caſt them away careleſly in the allies of my Garden, the which (notwithſtanding the extreme heate of the Sun, the hardneſſe of the trodden allies, and at that time when no rain at all did fal) haue growne as freſh where I caſt them, as before I did cut them off; which argueth the great coldneſſe contained therein. True it is, that it doth argue alſo a great moiſture wherewith the plant is poſſeſſed, but as I haue ſaid, not without great cold, which I leaue to euery mans cenſure.

¶ *The Vertues.*

A In Spaine and thoſe hot Regions they vſe to eate the Apples prepared and boiled with pepper, ſalt, and oyle: but they yeeld very little nouriſhment to the body, and the ſame naught and corrupt.

B Likewiſe they doe eate the Apples with oile, vinegre and pepper mixed together for ſauce to their meat, euen as we in theſe cold countries doe Muſtard.

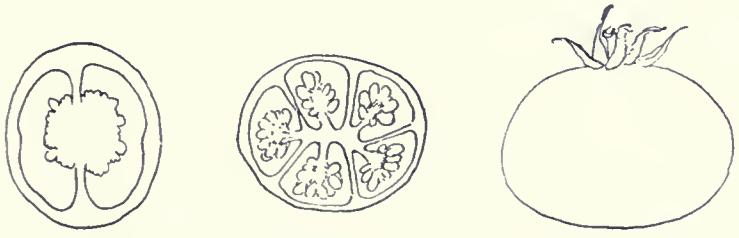
Early description of the tomato from the revised edition of John Gerarde's The Herball or General Historie of Plantes *(London, 1636).*

States until Thomas Jefferson grew them in 1781. It is said that French refugees in New York brought the custom of eating them from the West Indies in the 1790's and that they were used for food in New Orleans soon after the Louisiana Purchase.

Within a generation, as J. C. Furnas notes in his *The Americans* (New York, 1969), a certain Dr. Grant found them accepted from the Gulf of Mexico to the Great Lakes and endorsed by one doctor as a remedy for dyspepsia, diarrhea, and liver-trouble, for keeping the pores open, and for warding off cholera. Patent medicine companies were soon offering tomato extracts, tomato pills, etc. By the end of the 1800's tomato catsup had become the standard table fixture it still is and Americans were eating tomatoes in increasing quantities, both raw and cooked. But the fears died out slowly. I remember my Grandmother telling me that in her youth in Maryland (c1885) tomatoes were considered poisonous and only fit for hogs. At about the same time another relative recalled seeing a man publicly eat a tomato in front of an anxious crowd at the local Post Office.

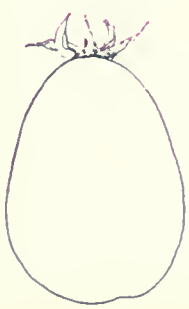
In England too the process of overcoming the old beliefs was a long one. Dickens obviously had the amorous associations of the love apple in mind in *Pickwick Papers* when he has Serjeant Buzfuz exclaim: "Chops! Gracious heavens! and Tomato Sauce! Gentlemen, is the happiness of a sensitive and confiding female to be trifled away by such shallow artifices as these?"

It appears that American influence played some part in winning the English over to the tomato. The eleventh edition of *Eliza Acton's Modern Cookery* (1851) contains five recipes for "Tomata" dishes, besides those for sauces and catsup. One of these is called "Tomatas en salade" and described by the author as "now dressed like cucumbers, with salt, pepper, oil and vinegar." How strange that Gerarde's Spanish recipe should be set before the English as "the American fashion!"



In his article "Lore of the Tomato" (*The Gardeners' Chronicle*, 3rd series, v. 126 (1949), p. 54), Charles A. Hall gives us a first hand account of the revolution in taste that has been accomplished in his lifetime: "When I was a small boy, say seventy years ago, it was commonly said that a taste for Tomatoes had to be acquired—no one liked them at the first eating. Actually, they never appeared on the table in my home and there was only one garden in our village where they were grown, as a novelty. I saw them in all their glory of red and yellow fruitage and felt that fruits so attractive in appearance must be good to eat. I was tempted to help myself to one and, alas! I fell. Great was my disgust when I came to taste it, for it was utterly nauseous to me and I quickly spat my mouthful out . . .

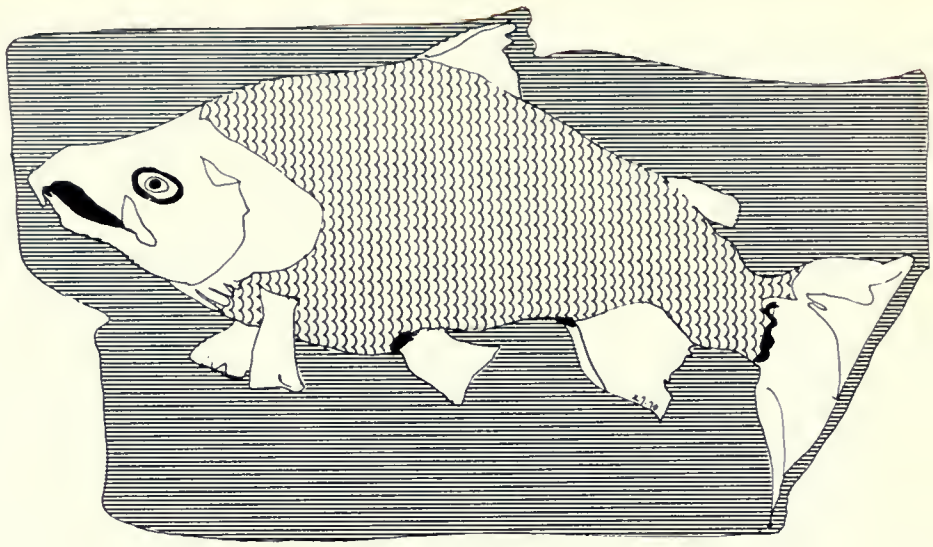
"Talking with folk of my own generation I find that most of them in their youth looked upon taste for the fruit as one to be acquired . . . Nowadays one does not hear of an acquired taste for Tomatoes or of people disliking them on first acquaintance . . . A fruit that was once a curiosity in this country, at first cultivated in the greenhouses of the wealthy, has now become ubiquitous and a common item of diet."



It has taken us a long time to appreciate the merits of the tomato and the great debt the whole world owes to the unknown Indian farmers who first discovered and developed it. In the end I am glad we do not have to choose one of the host of good foods that they have bequeathed to us as a rich legacy. □

The Changing Great Lakes

PART II



LOREN P. WOODS

This is the second part of a two-part article on the fishes of the Great Lakes. Part I, which appeared in the July issue of the Bulletin, *dealt with changes in the lakes, including the disappearance of the Atlantic salmon, the introduction of goldfish, rainbow trout and smelt, and the invasion of the sea lamprey and the alewife.*

The chain of events in Lake Michigan which began with the invasion of the sea lamprey during the 1950's and the explosion of the alewife population during the 1960's has led to a lack of balance among the various species which inhabit the lake. Both commercial and recreational fishing declined. Biologists, in attempting to reconstruct valuable fish production, have resorted to unprecedented large-scale introductions of three species of Pacific salmon, coho or silver salmon, chinook or king salmon and kokanee, a land-locked form of sockeye salmon. These introductions began in 1965 and have continued, with increasing numbers of salmon being released each year into both inland lakes and into Lake Michigan and Lake Superior streams.

So far, this program of salmon introductions, undertaken by the Michigan Department of Conservation, has achieved some of its primary objectives—the improvement of sports fishing, the promotion of the tourist industry and the restoration of predator-prey relationships. Although there appear to be no published reports that alewives are, in fact, the major salmon food, there have been verbal reports of salmon eating alewives. Hopefully, time will prove these reports to be true.

Chinook salmon were introduced into the Great Lakes in the late 19th century and again just after World War I. These established breeding populations for a few years and then disappeared. In 1967, over 800,000 young chinook were planted in three Michigan streams. When the temperature of the streams rises, the young migrate downstream and enter the lake. As the chinooks increase in size, they feed on lake herring, alewives and other small fish. Most chinooks mature in four years. Like the cohos, chinooks grow rapidly; in 1969 about 43,000 were taken by sports fishermen, weighing an average of fifteen pounds each. The Michigan Department of Conservation took 83,000 more chinooks and cohos at their wiers totaling 950,000 pounds. In 1970, one weighing 24 pounds was taken along the Chicago lakefront. Really large salmon are expected this fall as the first mature fish approach the streams.

If chinooks are principally dependent on alewives for forage, evidently the 1967 alewife die-off, followed by an apparent reduction in alewife abundance, did not influence either survival or growth of chinooks. Most of the alewife die-

Loren P. Woods is Curator of Fishes in the Department of Zoology at Field Museum.

off consists of three-year and older fish and some yearlings. Perhaps chinooks are eating pelagic two-year-olds.

In 1966, nearly one million 4 to 6 inch coho fingerlings were introduced into two Lake Michigan streams and one Lake Superior stream. By September, some of these had grown to 17 to 23 inches and weights of two and one-half to seven pounds. In 1967, more than two million coho were introduced into five streams, and in 1968, 3 million fingerlings were introduced. The recreational fishing that developed as a result of these plantings has been widely publicized and fishing has spread around the lake. The largest fish are caught in the late summer and early fall, when the adults return to their parent streams to spawn.

Unlike the other Pacific salmon, cohos have a three-year rather than a four-year life cycle. After fall spawning, the eggs hatch in mid-winter, the fry remaining in the nest for a few weeks. Once the fry have left the nest, they feed in the streams for one year before entering the lake. They grow rapidly in the lake; some males are ready to spawn after only one summer in the lake. The majority do not return to spawn until after their second summer, when they are three years of age. Once they reach maturity, they have only a few weeks to enter their parent stream and spawn before they die. They die even though they do not enter a stream or spawn.

The few streams in which cohos are planted do not have sufficient spawning grounds for the returning fish, so large numbers are diverted at the stream mouth, where they are led into impoundments. Some are taken to hatcheries, where they are used to produce more fry. The rest are given away or sold. Michigan has sent fry for stocking to the other states bordering Lake Michigan to increase the number of home stream runs and broaden the areas of summer-fall angling.

During the first year of coho salmon fishing, 1967, anglers caught about 35,000 fish. In 1968, about 100,000 were taken. There was a further increase in 1969 when anglers harvested 132,000 cohos, weighing 1.25 million pounds, an average of 9.5 pounds per fish.

THE ECOLOGICAL BALANCE.

How is the introduction of these various exotic salmon likely to affect the native fishes, whose adaptations to oligotrophic (deep, cold, clear lake water with low nutrient supply) conditions and whose ecological balance has been established over thousand of years?

From mere collecting of vital statistics on the stocks of commercial species, the various state and federal fishery departments have moved into management. But the management of a body of water the size of Lake Michigan is management of a system, the complexity of which is beyond anything ever attempted. If the principal abundant species is reduced to one forage fish—the alewife—whose numbers fluctuate widely because of periodic die-offs, and a couple of predator species—coho and chinook—this results in a highly unstable situation. Consider too, that this new management system is being superimposed upon the whitefish, chub and lake trout population and *their* foods. Lake trout are being introduced on a scale equal to that of salmon introduction in the hopes of restoring the predator-prey relationships between lake trout and chubs, both of which live in deep water.

Another matter that directly concerns everyone is whether this management can be carried out under the relatively free enterprise system we have now. Will even greater restrictions be placed upon commercial fishermen and the managing be done only for recreational fishing and associated enterprises? The use of large mesh gill nets was abolished in 1968 in parts of Lakes Michigan and Superior to prevent commercial fishermen from taking salmon, and presum-

Chicago Tribune photo

ably, to allow a building of breeding stocks of lake trout. Further restrictions are being considered. Will it be necessary to phase out commercial fishing?

The answers to such economic questions lie in the biological results of the present fish introductions. If these salmon can only be maintained by continued artificial means, requiring large brood stock, it may be necessary to find other solutions, such as controlling alewives by fishing beyond their reproductive capacity and reducing their numbers.

RISING DDT LEVELS. The most serious problem associated with the coho program has been with the residual pesticide, DDT. At one of the Michigan hatcheries, a large number of eggs and fry died and studies indicated DDT to be the cause. Eggs of Lake Michigan coho had DDT residues 2 to 5 times higher than eggs from Lake Superior coho. Losses from Lake Michigan fry ranged from 15 percent to more than 50 percent, while mortality of Lake Superior fry was negligible. Formerly, the state of Michigan sold excess coho to a commercial packing company for processing. Shipments of these frozen coho were found to contain significant DDT levels, but at the time, no standards had been set regarding a "safe" level for human consumption. In April, 1969, the Food and Drug Administration set a limit of 5 parts per million for DDT and its derivatives.

A three-year study (from 1965 to 1968) reported that levels of DDT and its breakdown derivatives, DDD and DDE, ranged from 3.5 to 5.5 parts per million in the eggs and from 5.0 to 8.5 parts per million in the flesh. This same study analyzed nine other species of fish from each of the Great Lakes, including two species which were common to all five lakes. The report, given by fish and wildlife physiologists Carr and Reinhart in 1968, concluded that, "Fish from Lake Michigan contained the highest concentration of DDT—two to four times as much as similar species from the other lakes . . . During the three years of this study (1965-1968), DDT levels in the Great Lakes fishes showed no detectable trend."

Chicago Tribune photo

DDT has since been banned in Ontario, Wisconsin and Michigan. Although strong bills to curb its use in Illinois have received much attention and support, action is still pending. However, this very concern has led to voluntary curbing of the use of DDT and other chlorinated hydrocarbons in the lake watershed.

It is very difficult to determine the amount of DDT and its derivatives in the environmental system. DDT has a great affinity for fat. It is taken up by organisms so quickly that it is useless to monitor the water. Some residues are found in bottom silt of lake tributary streams, but most of the DDT that gets into the water seems to pass through the food web and much is eventually concentrated in the predators—not only fishes, but also fish-eating and scavenger birds.

In areas where known amounts of DDT or other chlorinated hydrocarbons have been used and subsequent attempts have been made to trace it through the ecosystem, most was found to have disappeared, presumably taken up by organisms.

Apart from pesticides, there is another chlorinated hydrocarbon, the polychlorinated-biphenyls (PCB), which eventually can be expected to build up to levels exceeding those of DDT. PCB is virtually indestructible. It is concentrated in fish and birds in the Great Lakes and other regions in physiologically significant amounts. PCB is used in many industrial products—in the manufacture of plastics, paints, resins, hydraulic fluids and other products—which are eventually released into the environment. As yet, no studies have been made on tolerance levels of PCB or on its effects on animals of the food web, diatoms and planktonic algae.

Photo by John Hendry

THE CLADOPHORA MENACE. A recently developed nuisance, as a result of nutrient buildup in Lake Michigan, is an excess of the blanket weed, *Cladophora.* This dark green, filamentous, branching algae grows attached to rocks, pilings, seawalls and boats. When attached, it is a sheltering place for several kinds of small crustaceans and also a feeding and sheltering place for small fishes.

The nitrogenous wastes from domestic sewage and phosphates, especially from detergents and field runoff, are both essential nutrients for the growth of this algae. Field experiments have shown that if either nutrient is absent, *Cladophora* growth is minimal. Usually, phosphates and nitrates are not abundant in an oligotrophic lake such as Lake Michigan.

In spring, the rocks and pilings are bare of growth; *Cladophora* needs a water temperature of at least 50°. Other requirements are good light, clear, active water and sufficient nutrient materials.

In former years, *Cladophora* grew to only a few inches length during the summer and most of it remained attached to rocks. However, given sufficient nutrients, the filaments grow much longer and when pounded by waves during storms, are broken off. The mats of algae continue to grow, even though unattached, and drift along shore. If carried into turbid waters, some die and decompose, liberating their nutrients for recycling.

The problems with *Cladophora* that have arisen in many parts of Lake Michigan become acute when the floating mats plug water intake systems or are washed ashore onto beaches and begin to decompose. The shiny and amorphous mats look and smell like sewage. The beaches may be covered with windrows of algae and the edges and shallows of beaches offshore may

be anywhere from ankle to knee deep in algae. Since most *Cladophora* growth is in the areas of enrichment (i.e., excess nutrients mentioned above) in the vicinities of cities and because most of the algae that is broken loose is tossed onto nearby beaches, it is primarily the cities that are forced to deal with the problem. Removal is difficult because of the very nature of the algae. Chemicals and practical methods of destroying the mats offshore have not been developed. Having a crew of men rake the algae from the edge of the beach, then bulldoze it into piles or load it onto trucks, is not only highly inefficient, but very costly.

The only solution to the problem appears to be reduction of nutrient materials that the *Cladophora* depends on, and this is also costly. Sewage treatment can be and is quite effective in the removal of nitrogenous materials, but utilizing this method for the removal of phosphates is very expensive. One method of removal is to send the effluent onto land covered by plant growth, but few urban regions have such areas available for this type of disposal. Recycling of nutrients as well as other pollutants as such would seem to be at the heart of nearly all of our waste disposal problems.

Courtesy of Federal Water Pollution Control Administration

INDUSTRIAL POLLUTION. Overall, Lake Michigan is still in good condition. Its great mass of deep, cold water has maintained its oligotrophic condition and abundant life. However, industrial pollution continues to affect certain areas of the lake. The southern part of Green Bay is so badly polluted that the city of Green Bay draws its water across the peninsula from open Lake Michigan rather than from Green Bay. Other locally polluted areas are mostly in tributary rivers and in the vicinity of the larger cities.

The Calumet industrial area just south of Chicago, among the heaviest industrial complexes in the world, has significant pollution. Here are located ten major steel mills, five great petroleum refineries, five other large industries (mostly chemical) and a large number of smaller concerns. The kinds and number of aquatic plants and animals living here reflect the water quality in that area. According to government surveys by Federal Water Quality Administration, pollution become more severe between 1965 and 1967. The amounts of iron, sulphates, cyanide and phenols were all significantly higher. The water quality at a southern Chicago and a Gary water intake were below standard. Generally, conditions on Chicago beaches and Indiana beaches were satisfac-

tory, except when winds locked in contamination. The worst form of contamination so far has been periodic oil spills or bilge oil. This has extended along shore, causing beaches to be closed and bird kills. Not only a local problem, oil spills occur in many industrial harbor areas throughout the Great Lakes.

The same water of the Great Lakes is used over and over again. In 1954 there were 2000 industries using nearly 3000 billion gallons of Great Lakes water. 96 percent of this was returned to the source after using. The greatest industrial water use in the Great Lakes is for electrical power. Steam generators take water through their turbines and return it to the source relatively unchanged. The next greatest use appears to be in the primary metal industries, which utilize nearly half of all water withdrawn. All other industries utilize the other half.

POLLUTION AND PUBLIC CONCERN. Until quite recently, water pollution has been primarily a concern of the public health departments. If there were no known pathogens and if the water smelled and tasted all right, its quality was considered good.

During the past three years, other forms of pollution have been mentioned in the scientific literature, and more and more often in the news. There were reports of mercury poisoning from Japan in 1953, 1960 and 1965 (more than 100 people were killed or disabled in one community). In Sweden, bird populations decreased and subsequently fresh water fish were found to contain large amounts of mercury. Various mercury compounds are used in pulp and paper production, as fungicides—especially in treatment of seeds, in herbicides (crab grass control) and in antifouling paints for ships as well as in the manufacture of other products. In April, 1970, because of their mercury level, fishes from Lake Erie were withdrawn from the Canadian market and embargoed; a month later, all commercial fishing in Lake Erie was ordered halted by the state of Ohio. About the same time, sport fishing in Lake St. Clair and in the St. Clair River were banned by Michigan. Within the past few weeks, mercury has been found in Lake Michigan waters. There are reports from many other regions that fishes and drinking water have been found to contain dangerously high levels. Mercury, like DDT, moves through the food web of aquatic animals and regardless of the chemical form in which it is introduced, it is eventually converted to its most toxic form, methyl-mercury. There have been Senate Commerce Committee meetings and international meetings between the United States and Canada on the problem. Where sources of pollution have been located, the mercury levels have been reduced or eliminated.

Sun-Times photo by Bob Kotalik

Airports and dikes sealing off the southwest corner of Lake Michigan may become the most important problems in the future. But there are numerous immediate problems and insufficient information to lead us to a quick solution. At least we now recognize that to maintain water quality, there must be a thriving aquatic life.

The problems won't wait while the laborious data collecting and analysis are completed. Despite the upswing of investigation by government and private agencies and institutions, despite the large numbers of people working on lake problems, both biological and physical, much more has to be learned if we are to stop the deterioration of water quality. Changes in the lake waters and biota cannot be stopped, but the process of increasing nutrients can be slowed, temperature levels can be held to normal and input of toxic materials can be stopped.

Pollution problems are increasing. Great expenditures of effort and money are going to be required to prevent further deterioration and preserve the lake, our most valuable resource, so it can be used in the future as it has been in the past. □

DIEFFENBACHIA – A POISONOUS HOUSE PLANT

DR. JOHNNIE L. GENTRY, JR.

Dumb cane is probably the most common source of poisoning from house plants. It is a member of the aroid family. A native of tropical forests, it has become a common household plant and is used ornamentally in public places.

The irritant property of dumb cane has been known for centuries. The natives of the upper Amazon used one species in combination with curare as an arrow poison. The cut stalk was rubbed into the mouths of slaves in Jamaica as a form of punishment. Roots of the plant were sliced and boiled in wine for use as a bath in the treatment of gout.

The plant produces an intense burning sensation when eaten raw and is accompanied by severe swelling of the mouth and tongue. This leads to difficulty in swallowing or to complete inability to swallow. The swelling usually begins to lessen in about four days, but the pain abates more slowly and remains severe for about eight days. The juice will produce dermatitis in susceptible individuals when brought in contact with the skin. *Dieffenbachia* gets its common name (dumb cane) from the effect it has on the mouth and tongue. Speech becomes thick and unintelligible and sometimes the tongue is completely immobilized. Some people have even suffocated as a result of their tongue's having swelled so much that it blocked their air passages.

It was originally believed that the toxicity of dumb cane was due to the needle-like calcium oxalate crystals in the juice of the plant. Others have suggested that it might be caused by the presence of alkaloids, saponins or a toxic protein. Just recently, F. W. Fochtman and co-workers demonstrated that the toxicity of the juice is actually caused by a "protein-like" substance rather than the oxalate crystals. Certainly, at least a part of the pain is caused by irritation of the sharp pointed crystals penetrating the tissues of the mouth and tongue.

Some people find it difficult to believe that a plant as common and familiar as dumb cane could possibly cause such pain and discomfort. The first bite is enough to prove the point in question.

Many other cultivated aroids will cause a similar reaction. These include such commonly known plants as: alocasia, caladium, calla lily, elephant's-ear, malanga, and some philodendrons.

Wax and plastic models of some members of the aroid family can be observed in the Museum's Hall 29, case 812. □

Dr. Johnnie L. Gentry, Jr. is Assistant Curator of Botany at Field Museum.

THE MUSEUM'S FIRST MILLION

The following article is Edward E. Ayer's own account of how Marshall Field donated the first million dollars to start Field Museum. Ayer was the first president of the Museum, from 1894-98. The account is excerpted from The Life of Edward E. Ayer, *by Frank Lockwood and published in 1929.*

Previous to the Chicago Exposition in 1893, I had collected very extensively material on the North American Indians, putting myself in touch with all parts of North America through Indian traders wherever I could hear of them; and I finally got in contact with most of them. I had bought Indian paraphernalia in considerable quantities, and in the World's Fair my private collection exhibited in the Department of Anthropology constituted quite an important section of that exhibit. During the Fair I often went to see the different collections and, indeed, studied everything very carefully; and as a result I early saw that there would be a tremendous amount of material from different countries, as well as from all parts of America, that could be secured at a minimum price at the end of the exposition. I had collected a good deal in the Americas and had already collected a little here and there in Europe during the several years that I had been going abroad, and I felt that the time had come to start a natural history museum in Chicago at the end of the World's Fair and that the opportunity should not be allowed to pass.

At the various Chicago clubs I came into familiar association with the leading men of the city at the table and at card games, so I began on all occasions to urge the importance of our getting material for a museum at the close of the World's Fair. There were several others who thought as I did—among the principal ones being George M. Pullman, Norman Ream, and James Ellsworth. These men endorsed and backed up my remarks. Of course Marshall Field was the richest man we had among us in those days, so during our fishing trips and on social occasions when I would meet Mr. Field I began to talk to him (and others did, too) about giving a million dollars to start with. He always responded,

"I don't know anything about a museum and I don't care to know anything about a museum. I'm not going to give you a million dollars."

It went on this way, but we were all good enough friends to permit of our talking about it whenever the opportunity arose, so it was broached to Marshall Field a good many times before the end of Fair, but he persistently answered as at first. Finally, when it was only a month now until the end of the Fair, a meeting was called and a committee of about twenty was appointed to see what could be done about a museum. I was not present at the first meeting, but I was at the second. By this time the widespread business panic of '93 had developed, and those present at the first meeting saw plainly that we were going to have a difficult time to raise the money for the museum. They know that Marshall Field had repeatedly been unsuccessfully approached for a gift of a million dollars—the amount considered necessary to make a start—so at this first meeting they had concluded the only thing they could do would be to raise two or three hundred thousand dollars, buy what they could with that small amount of money, get donations of as much of the material exhibited as possible, and store everything until with the coming of better times they could secure the museum.

I was asked my opinion and replied that I thought the plan would be impossible for the reason that ninety per cent of the natural history material, such as feather-work and leather-work would deteriorate and in time be destroyed. They then asked what I would suggest in place of the plan they had presented. My advice was that, in view of the impossibility of starting our museum, we raise as much money as possible, purchase what we wanted, and from this make four working collections—one for the University of Chicago, one for Northwestern, one for Beloit College, and one for the University of Illinois. I was asked what I would do in that case with my Indian collection. I said I would give that to the University of Chicago, or dispose of it in any other way that the members of the committee thought best. I went away from the meeting and that very night got a letter from James Ellsworth asking me if I would not see

Edward E. Ayer shown in a portrait surrounded by American Indian artifacts and books.

Courtesy of the Newberry Library

Marshall Field once more. I wrote back that I would do so, but that I did not believe it would do an atom of good.

The next morning I was in Mr. Field's office when he arrived at about half past nine. I said:

"Marshall Field, I want to see you tonight after dinner."

"You can't do it," he replied, "I have a dinner party and shall be late."

"Well, the next night."

"No, I have another engagement then."

"Well, I have to see you right away; it is important."

"You want to talk to me about that darned museum," was his reply to this.

"Yes," I admitted.

"How much time do you want?"

I replied, "If I can't talk you out of a million dollars in fifteen minutes, I'm no good, nor you either."

"He got up, closed the door, came back, and said, "Fire ahead."

I commenced in this way, "Marshall Field, how many men or women twenty-five years of age or younger know that A. T. Stewart ever lived?"

"Not one," he replied.

I continued, "Marshall Field, he was a greater merchant than you, or Claflin, or Wanamaker, because he originated and worked out the scheme that made you all rich; and he is forgotten in twenty-five years. Now, Marshall Field, you can sell dry goods until Hell freezes over; you can sell it on the ice until that melts; and in twenty-five years you will be just the figure A. T. Stewart is—absolutely forgotten. You have an opportunity here that has been vouchsafed to very few people on earth. From the point of view of natural history you have the privilege of being the educational host of the untold millions of people who will follow us in the Mississippi Valley. There is practically no museum of any kind within five hundred miles; and these children who are growing up in this region by hundreds of thousands haven't the remotest opportunity of learning about the ordinary things they see and talk about and hear about every day of their lives, and it does seem a crime not to provide them with the information they need."

I talked fast and steady. Finally, he took out his watch and said, "You have been here forty-five minutes—you get out of here."

I replied, "Marshall Field, you have been better to me than you ever have been before; you have always said No, and you haven't this time—yet. Now I want you to do me a personal favor: I want you to go through this World's Fair with me and let me show you the amount of material that is there—I mean exactly what there is that can be used in a natural history museum; for the collections can be gotten very cheap, much of the material for nothing. I want you to go through the World's Fair with me before you say No."

"Well, Ed," he replied, "I should like to go through with you. George Pullman told me that you had shown him through and that he had been astounded himself at the quantity of material that was there. My brother Joe is here and I should like to have you go with us. We will do it tomorrow morning at ten

o'clock."

We went through the whole exhibition. When we came out a little before one o'clock, I said, "Can Norman Ream and I come to your office tomorrow morning at half-past nine and see you about this matter?"

"Yes," he answered.

We were there promptly, and he gave the million dollars with which to start the Museum. George Pullman gave a hundred thousand, Mr. Harlow Higinbotham gave a hundred thousand, my friend Mrs. George Sturges gave fifty thousand, and I put in my collection which was estimated to be worth a hundred thousand. In addition to all this the great concerns that had provided money for the founding of the World's Fair contributed their shares of exposition stock and, as we realized about fifty cents on the dollar on this, we had about a million and a half dollars to begin with, besides a large amount of stuff that was given to us from the various exhibits.

□ □ □

During all the remainder of his life Mr. Field's interest in the Museum increased. He left a bequest of eight million dollars at the time of his death, and he had in mind a final magnificent gift when he suddenly passed away. He, personally, enjoyed the Museum very much and from time to time made large contributions toward the current expenses of the Institution; so, naturally, his relatives and friends became interested. A nephew, Mr. Stanley Field [President of the Museum from 1908-1962] is, and has long been, president of the institution; and Marshall Field's grandson [Marshall Field III] annually gives very large amounts for its support.

Edward E. Ayer

The Field Columbian Museum, as it was then called, was formally opened June 2, 1894. Mr. Ayer presided, having been elected as its first president. It was a notable occasion. The orator of the day, Mr. Edward G. Mason, closed his inspiring address with these words:

Marshall Field

The first museum, from which the name has been handed down through the centuries, established by the old Egyptian king in the once proud city of Alexandria, was set apart for the use of one privileged class alone. But this museum knows no distinction of class or condition of men. It holds for all its wealth of opportunities for instruction and for research, and its treasures are to be had for the asking. No man can measure the amount of pure and elevated pleasure, of real and lasting benefit, which will be derived from it by the multitudes who will throng its halls from this time henceforth. Nor can we lightly estimate the continuing tribute of thankfulness which they will gladly pay to its benefactors and especially to those whom we honor as its founders. To them it is not easy to render a fitting meed of praise. But they already have a reward in that consciousness of a grand deed grandly done, of which nothing can deprive them. This great creation is due to a munificence far more than princely. A prince can only give his people's money. These donors have given of their very own freely, lavishly, for the good of their city and of their race. As we enter into their labors there enter with us the rejoicing shades of the philanthropists of all time to welcome this latest exemplification of the spirit of those who love their fellow men, and in their shining list will forever appear the names of the founders of the Field Columbian Museum.

At the close of this eloquent peroration, President Ayer, who was to live to see the whole vision and prophecy come true, with raised gavel said, "I now declare the Field Columbian Museum open." □

Photo by Ben Kozak

Daybreak Song

All night the gods were with us,
Now night is gone;
Silence the rattle,
Sing the daybreak song,
For in the dawn Bluebird calls,
With voice melodious, Bluebird calls,
And out from his blankets of tumbled gray
The Sun comes, combing his hair for the day.

Navajo Ceremonial Song

Sixteenth Century church of Nuestra Senora de la Merced in Antigua, Guatemala.

GUATEMALA TOUR — OCTOBER 24 TO NOVEMBER 8

Field Museum's Natural History Tour of Guatemala promises not only exciting places to visit, but expert guidance as well. The principal ruins the Tour will visit are Kaminaljuyu, believed by many archaeologists to be the site of the culture which later moved to Tikal; Iximché, a highland center of the Maya Quiche; and the rain forests ruins of Tikal, one of the most important and largest centers of the classical Mayas.

The Tour will also visit private homes and gardens in Guatemala City, colonial Antigua, on the slopes of the Volcano Fuego, in Pacific lowland jungles and at highland Quezaltenango. Mountain pine forests, sub-tropical Lake Atitlan, the Pacific lowland tropics and the rain forests of Peten will be visited.

Climaxing the Tour will be the traditional festivities on All Saints Day at Chichicastenango, when the rituals and colorful processions blend Christianity with Mayan paganism. Serving as the Tour's expert on the ruins and on the Indian communities will be Dr. Edwin M. Shook, one of the world's leading archaeological specialists on the area. Dr. Shook headed the Tikal project of the University from 1955 to 1964; he is executive director of the John Lloyd Stephens Foundation, which specializes in Maya research. For the past year, Dr. Shook has been engaged in excavations at Monte Alto, Guatemala.

Dr. Jorge Ibarra, the Director of Guatemala's National Museum of Natural History and the Editor of the magazine "Natura y Pro-Natura," will join the tour at Lake Tikal. An internationally famous ornithologist, Dr. Ibarra was largely responsible for the recent establishment of Lake Atitlan as a refuge for the flightless grebe, an endangered species which exists no place else. He will also accompany the tour to Tikal, site of rain forest fauna. Phil Clark, Natural History Tours Chief, will lead the tour, and serve as the specialist on horticulture and botany.

FIELD BRIEFS

NEW POSITION FOR DR. INGER

Dr. Robert F. Inger has been appointed Chairman, Scientific Programs at Field Museum of Natural History. Dr. Inger joined the Museum staff in 1946 as Assistant, Division of Amphibians and Reptiles, and has served as Curator of Amphibians and Reptiles since 1954.

As Chairman, Scientific Programs, a position recently created by the Museum, Dr. Inger will act as principal scientific advisor to the Director, and coordinator of interdepartmental scientific affairs.

Dr. Inger lectures in biology at the University of Chicago and is Adjunct Professor of Anatomy at the University of Illinois (Medical Center). He serves as Chairman of the Study Committee of the Ecological Society of America.

The recipient of numerous research grants, Dr. Inger has recently returned from Malaysia, where he investigated the ecology of amphibians and reptiles in conjunction with a National Science Foundation grant.

Dr. Robert F. Inger (right) sorts and catalogs specimens of frogs and lizards while on a recent expedition to Borneo. Working with Dr. Inger are two Dyak youths.

SUMMER SCHOLARS

Field Museum has granted four scholarships to students interested in Museum work for summer 1970. The students are spending the summer in the Museum's scientific departments studying various aspects of research and collection care.

Shinner Scholarships were awarded to Donald Shuster from Michigan State University, who works in the Department of Geology with Dr. Eugene S. Richardson, curator of fossil invertebrates, and Walter Koenig from Stanford University, who is spending the summer with Loren Woods, curator of fishes.

Veronica Sebeok from the University of Chicago, who has been granted a Le Bus Scholarship, is working under Dr. Donald Collier, chief curator of anthropology. Working with Philip Hershkovitz, research curator of mammals, is Madeline D. Kanner from the University of Wisconsin, who was awarded a Rowley Fellowship.

EXPEDITIONS

During the month of September, Dr. John Clark, associate curator of sedimentary petrology, and Orville L. Gilpin, chief preparator of fossils, will continue their ongoing research into ancient climates and geography in Wyoming, Colorado and Nebraska.

Dr. Bertram Woodland, curator of igneous and metamorphic petrology, will lead an expedition to the northeastern states and Quebec from July 20 through August 8. He will visit a number of sites in the area to examine and collect structures in metamorphic rocks with particular attention to special features of mineral development and occurrence.

NEW CAMERA CLUB PRESIDENT

Dr. William C. Burger, assistant curator of vascular plants, has been elected president of the Nature Camera Club of Chicago. The club, one of the few of its kind in the country, is open to any amateur photographer with an interest in nature. Members meet at the Museum the second Tuesday of each month except in July and August. The club is well known for the annual Chicago International Exhibition of Nature Photography which it co-sponsors with Field Museum and which draws thousands of photographic entries from all over the world.

FIELD BRIEFS

STANLEY FIELD HALL RECEIVES AWARD

Stanley Field Hall was recently presented an award at the 16th Annual Distinguished Buildings and Honor Awards Program, sponsored by the Illinois Chapter of the American Institute of Architects and the Chicago Association of Commerce and Industry.

The award cited the remodeling of the hall, which was completed in 1968. The juries, composed of well-known Chicago architects, designers, professors and deans of schools of architecture, praised the "restrained mood of the hall, in keeping with the formality of a museum."

In the remodeling, two fountains, totem poles, key lighting, and marble benches were added. New platforms were constructed for the elephants and the dinosaur, and their positions shifted.

VOLUNTEERS HONORED

Thirty-seven volunteers who contributed a total of 6,116 hours to Field Museum during 1969 were honored recently at a reception at the Museum.

The volunteers served an average of 165 hours per person during the year. The highest individual figure was 864 hours. The total number of hours represents an increase of more than 50% over 1968.

In honor of their dedication, each volunteer received a reproduction of a Lion-Dog from the Ch'ing Dynasty (A.D. 1644-1911) that is in the Museum's permanent collection. The decorative gilt-bronze piece is a symbol of courage and protection in Asian Buddhism and folklore.

Twenty of the men and women assisted in the Museum's departments of anthropology, botany, geology and zoology, the library and the exhibition department. Their work ranged from filing and typing to cataloging of specimens and restoration work.

Seventeen volunteers, specially trained as greeters and guides, served the Museum's Department of Education, supplementing the work of staff lecturers. In 1969, the department gave 1,993 organized tours, involving 77,327 youngsters. Of this figure, 398 groups, or 11,354 students, were handled by volunteers.

STUDENT EXPEDITION IN ARIZONA

Twelve undergraduate students from colleges and universities throughout the country are participating in Field Museum's seventh annual, tuition-exempt summer archaeological program at the Museum's field station in Vernon, Arizona.

Under the direction of Dr. Paul Martin, chief curator emeritus of the Museum's anthropology department, and supported by a National Science Foundation grant, the program is designed to allow each participant to conceive and test hypotheses dealing with cultural processes or changes in past sociocultural systems. Students will collect data relevant to their individual project from excavations or reconnaissance, analyse and test, learn how to do research and how to set forth the results in lucid exposition.

"Our ultimate goal (as archaeologists)," Dr. Martin told the students, "is to formulate laws of cultural dynamics in order to explain cultural changes over long time spans . . . The results *will* be relevant to *contemporary* problems because they will allow us to understand the cultural principles that govern or cause these problems, and therefore will enable us to construct meaningful solutions."

Eric Gritzmacher, Ezra Zubrow and John Johnson (l to r) are among the 12 students participating in the archaeological program at Vernon, Arizona.

field museum's natural history tours

gardens
wild flowers
birds
archaeology
congenial travel companions
interpretations by experts
the unhurried approach
travel with all dimensions

GUATEMALA
LAND OF COLOR & CONTRAST
Oct. 24-Nov. 8
$1,280 includes $400 donation
Gardens at Guatemala City, Antigua, Volcan Fuego, Quezaltenango. Ruins of Tikal, Iximche, Kaminaljuyu. Chichicastenango on All Saints Day. Lake Atitlan.

THE INCA'S EMPIRE
& DARWIN'S GALAPAGOS
Two sections: Dec. 31-Jan. 29, 1971,
& Feb. 4-March 5.
$2,807 includes $600 donation.
(22 days of Andes, $2,457; 11 days of Galapagos cruise & Quito, $1,190—separately) Gardens in Bogota, Lima, La Paz, Quito. Ruins of Machu Picchu, Chan Chan, Pachacamac, Cajamarquilla, Ollantaytambo, Cuzco, Lake Titicaca, Tiahuanaco. Spanish Colonial art & architecture in Colombia, Peru, Bolivia and Ecuador.

LEADER ON ALL TOURS, PHIL CLARK, former Editor of Horticulture magazine; former Garden Editor of The News, Mexico; author, "A Guide to Mexican Flora"; Field Museum Natural History Tours Chief; accompanied by Archaeologists specialized in the areas.

All donations to Field Museum are tax deductible.

Rates are from Chicago; may be adjusted from other points.

Write: Field Museum
Natural History Tours
Roosevelt Rd. at Lake Shore Dr.
Chicago, Ill. 60605

CALENDAR

HOURS:
Monday, Tuesday, Thursday
9 a.m. to 6 p.m.
Wednesday, Saturday, Sunday
9 a.m. to 8 p.m.
Friday
9 a.m. to 9 p.m.
The Museum Library is open
9 a.m. to 4:30 p.m.
Monday through Friday

THROUGH AUGUST 31:

A Cast of Australopithecus boisei, a hominid cranium about 1.75 million years old. Discovered in Olduvai Gorge, Tanzania by Mary Leakey in 1959, it was found associated with crude stone tools. South Lounge.

Summer Journey for Children, "West African Art and Music." A free, self-guided tour designed to familiarize youngsters who can read and write with art forms of four West African peoples. Journey sheets available at Museum entrances.

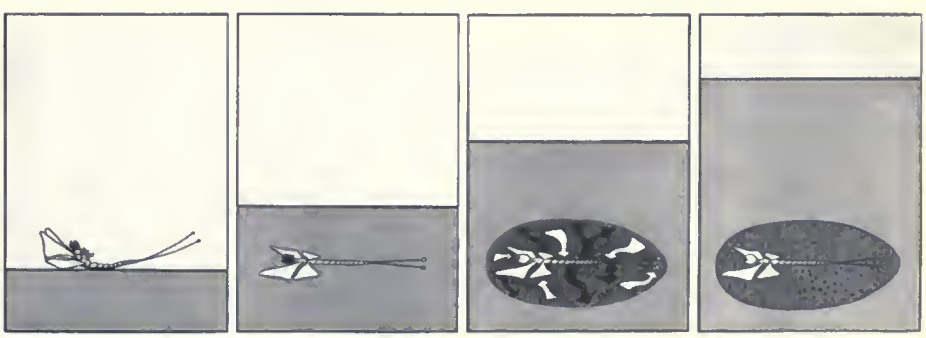
THROUGH SEPTEMBER 4:

Free Guided Tour and Film Program — Monday through Friday
2 p.m.: Museum "highlights" tour — Leaves North information desk.
3 p.m.: "Through These Doors" — Behind the scenes at Field Museum on film — Lecture Hall.

CONTINUING:

John James Audubon's elephant folio, "The Birds of America," on display in the North Lounge. A different page of this rare, first-edition copy, gift of an anonymous donor, is shown daily.

75th Anniversary Exhibit: A Sense of Wonder, A Sense of History, A Sense of Discovery, examines man and his world, the history of Field Museum and current research projects through exciting display techniques. Hall 3.



SPECIAL TEMPORARY EXHIBIT:

Illinois By the Sea: A Coal Age Environment, continues through October 25. Two sites once located on the shores of an inland sea that occupied Central Illinois 300 million years ago are graphically explored. One section presents marine and non-marine fossil concretions of an unusual nature. Another vividly shows how the fish population reacted when over-crowding occurred. Hall 9.

bulletin

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Volume 41, Number 8
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the vanishing

peregrine?

by Melvin A. Traylor

"Yet, when I say that man has wiped out 10,000 species of insects and snails in the past 200 years, at most there are raised eyebrows." Alan Solem, *Bulletin* Field Museum, April 1970.

When Dr. Solem penned the above words, he was forcefully illustrating the anthropocentrism of man, that characteristic that causes him to place the most value on those forms of life that are "highest," i.e. nearest to man, in the animal kingdom. While man may bemoan and write books about the passing of the Passenger Pigeon or the Carolina Parakeet, the disappearance of bugs and slugs excites no interest. But despite all, man's anthropocentrism has some redeeming features; when an animal with which man can identify is endangered, all available resources are marshalled to save it.

The Peregrine Falcon is certainly one of our most magnificent birds, graceful, swift and bold, the perfect hunter. It has been associated with man since the earliest records of falconry, which date back to 2000 B.C. in the Orient. Falconry, the art of hunting with the diurnal birds of prey, was and still is a sport of the aristocracy of the Middle East, and was introduced on a large scale in Europe with the return of the Crusaders. By the 12th century it flourished in all countries of Europe and in all ranks of society.

The Peregrine feeds on other birds, and hunts by circling above its quarry, and then dropping down on it in a fierce dive or swoop. If it misses, it uses its momentum to again climb above its prey, so that it may stoop again and again until it seizes the victim. Pairs of Peregrines often hunt together; one waits while the other chases the prey into a vulnerable position. This spectacular mode of hunting made the Peregrine the favorite of falconers, and its use was restricted to royalty and the higher nobility. Although popular interest in Peregrines declined as firearms relegated falconry to an esoteric sport, it has been revived in many cities by the falcon's willingness to accept modern skyscrapers as substitutes for the natural cliffs on which it normally nests. Some pairs have successfully raised their young in this situation, feeding them on the abundant city pigeons; the most successful and best publicized individual was a female that raised 21 young in 16 years on the Sun Life Assurance Building in Montreal.

The female Peregrines are much larger than the males. Female dominance is an important factor in successful pairing, for the size difference enables the pair to take advantage of a greater range of prey. Peregrines go through a complicated courtship ritual. Food may be offered or dropped to the female on the ledge, or transferred to her in the air. The pair may indulge in billing at the nest; they may nibble toes, and mutually preen feathers. They also may chase each other and stage mock attacks.

The female Peregrine usually lays three to five eggs, and incubation takes about 30 days. In the early stages, the male supplies all the food. The length of time required for development depends partially on how often and how much the young Peregrines are fed. The young remain with their parents in the general

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vicinity of their nest for two weeks to a month. In some species, hunting groups of juveniles are organized; eventually these are broken up by either fall migration or the invasion of aggressive territory-seeking adults.

When it became evident in the late fifties that the number of Peregrines was suffering a catastrophic decline, a concerted effort was made in many nations to find the causes and to remedy them. Through the cooperation of students around the world, the main reasons for the decline are now known. The remedy will require the cooperation of the political world as well as the scientific; hopefully we will someday be able to show how the Peregrine was saved rather than how it became extinct.

Prior to World War II, the Peregrine was a highly successful species, occurring as a breeding bird throughout the world, from the subarctic regions to Australia and southern South America. Even in the heavily populated areas of Europe and America it held its own, despite the attention of egg collectors and falconers who often took young birds from the nest. One reason for its success was its habit of nesting almost invariably on vertical cliff faces in remote areas, where it was comparatively free of molestation. Some of the best known nesting sites in the United States were the Palisades along the Hudson River. The Peregrine fed almost entirely on other birds, usually shorebirds and waterfowl. In more urban areas, however, its favorite prey was pigeons, particularly the homing pigeon which was trained to fly in a straight and undeviating path, and was thus more vulnerable to attack. The population of Peregrines in the eastern United States before the war was probably 350-400 breeding pairs.

This female Peregrine raised 21 young in 16 years atop the Sun Life Assurance Building in Montreal. They lived on the abundant city pigeons.

The serious decline of the Peregrine began in the late forties in the eastern United States and Germany, and by the mid-fifties was general throughout the United States and northern Europe. However, the impact of this change was slight at first. Most observers were regularly watching only a small number of eyries, or nesting sites, and when these began to be abandoned, or the pairs failed to raise young, each observer thought he was dealing with a purely local problem. One of the first to publish on the problem of declining productivity was C. Demandt, an ornithologist in North Rhine-Westphalia. He noticed that beginning in 1946, pairs were raising fewer and fewer young, and in 1950 he suggested that this might be caused by superannuation, that is, the remaining birds were too old to lay viable eggs. In the United States, Herbert and Skelton reported at the 1953 meeting of the American Ornithologists' Union that the Peregrines of the Hudson River series had failed to raise even a single young that year.

By 1958, continuing reports of declining numbers caused the Finnish League for the Protection of Nature to begin a full scale investigation. A questionnaire to the nation's ornithologists and an extensive field investigation revealed that only 35 of 151 known eyries were occupied that year. The date of the beginning of this drop in numbers could not be determined, but it must have been in the early fifties. This same year, 1958, saw the first recognition of the problem in Great Britain when Derek Ratcliffe of the Nature Conservancy reported ex-

tensive egg eating among breeding birds, a sign of decreasing productivity. Ironically, the subsequent investigation made in 1961-62 by the British Trust for Ornithology was in response to complaints by pigeon fanciers that Peregrines were increasing their depredations on homing pigeons. This was quickly disproved when it was shown that the species was virtually extinct as a breeding bird in England and Wales.

The first cooperative study in the United States took place in 1964. In 1939-40, Joseph Hickey, now of the Department of Ecology, University of Wisconsin, had made a survey of all known active eyries east of the Mississippi, then numbering about 200. In 1964 he organized a re-run of his earlier study, and during that summer 133 eyries were visited, distributed geographically from Kentucky to Maine. In all this area, not a single occupied site was found; the species was extirpated east of the Mississippi.

Jolted by this catastrophic decline and by similar situations among other birds of prey that had been reported at a recent Working Conference on Birds of Prey and Owls that had been organized by the International Council for Bird Preservation, Hickey called for an international conference on Peregrine populations, that was held at the University of Wisconsin in September 1965. The response in Europe and North America was enthusiastic, and 63 members and observers from eight nations attended. Support for the Conference and the studies that were there reported on came from a wide variety of sources; the Federal Government, state conservation departments, private foundations, and the pockets of many individuals who paid their own way.

A 17th Century Dutch painter, Aelbert Cuyp, portrayed this Peregrine falcon and its young master. (Metropolitan Museum of Art)

The picture that emerged was consistent on both sides of the Atlantic; in almost all countries the populations of Peregrines were down to only a few percent of their pre-war numbers. Only in the wilderness areas of Canada and Alaska were they holding their own. A few figures may illustrate this:

	Nesting Pairs	Year	Nesting Pairs	Year	% Decline
Western Wisconsin	11	1955	0	1964	100
Massachusetts	12	1947	0	1957	100
Pennsylvania	17	1946	0	1960	100
Finland	35*	1958	6	1964	83
West Germany	320-380	1950	70-90	1965	78
Sweden	39	1954	8	1963	79

in itself a low figure that had excited concern.

What were first believed to be local reductions in isolated areas could now be seen as a population crash on two continents.

The next obvious problem was to determine the cause or causes of this crash. There were a few areas where special factors were operable that could be easily seen. Along the Hudson River, the construction of the Palisades Parkway destroyed one eyrie and caused the abandonment of several others, since the birds are intolerant of human activity around their nests. In some areas of West Germany where the Peregrine fed mostly on homing pigeons, pigeon fanciers persecuted it relentlessly, even to the extent of blasting the cliff faces to destroy the eyries. But these factors, although important locally, cannot explain the synchronicity of the population crash extending over two continents, and even less the fact that other raptors (birds of prey), particularly the Osprey of the eastern seaboard, suffered similar declines simultaneously. The governing cause

must be one that is common to developed countries, since only the wilderness populations remain unaffected.

The most obvious culprits, and ones that were fresh in people's minds following the recent publication of Rachel Carson's *Silent Spring,* were the chlorinated hydrocarbon pesticides, DDT, Dieldrin, and their relatives and derivatives. This group of chemicals has one characteristic that makes them extremely effective as a pesticide; they are not only highly toxic but they are persistent, that is, they remain in a toxic form for years instead of quickly breaking down into their harmless constituents. This persistence affords a longer protection against agricultural pests, but it poses a threat to other forms of life because of the cumulative effect of the poisons. When the chlorinated hydrocarbons are consumed by an animal, they are retained in the body rather than excreted, and the continued consumption of small doses may lead to the accumulation of a lethal concentration in the organism.

Against this type of poison, predatory animals are particularly vulnerable because they stand at the end of food chains in which there may be one or more stages of concentration. A striking illustration of this comes from a study of Lake Michigan by Hickey, Keith and Coon (1966).

	PPM of DDT and derivatives (parts per million)
Bottom sediments	**0.014**
Invertebrates in sediment	**0.4-0.5**
Fish feeding on invertebrates	**3.4-5.6**
Gulls feeding on fish muscle	**99.0**
Gulls feeding on fish fat	**2441.0**

The concentration in the fat of the bird is almost 200,000 times that of the bottom sediments. Similar food chains exist on land, and the Peregrine, which breeds and feeds in a variety of habitats, participates in both. The fact that many of our streams and lakes are contaminated,

as well as our agricultural areas, could explain how the bird-eating Peregrine and the fish-eating Osprey could be decimated by a single cause.

The timing in the use of DDT and its derivatives also coincides with what is known of the population decline of the Peregrine. During World War II, DDT was used mainly by the Army in its delousing and anti-malaria campaigns, but in 1946 its widespread use in agriculture began. It was in the following years that the first declines in breeding success were noted. In low doses, DDT effects breeding success. The reduced number of young per pair, always preceded the reduction in total numbers. Nesting failures took the form of broken eggs that were eaten by the parent, eggs that failed to hatch, or mated pairs that failed to lay at all. Whatever the cause, it affected the reproductive potential before it was lethal to the adults.

Geographically, the areas of drastic reduction of Peregrines and of intensive agriculture and the use of pesticides coincide. In Great Britain, the only area where the Peregrine has maintained its numbers is the northern and western highland of Scotland, and this is the one area where there is no agriculture or agricultural chemicals, the land being used for sheep pasturing. The boglands of northern Finland, where there has been a drastic drop in the population, seems an exception because there is no agriculture that far north. However, banding returns have shown that Finnish birds winter in the heavily agricultural areas of France, where they have ample opportunity to absorb the chemicals prior to their return in the spring to breed. Collection of specimens has shown that they do just that. In North America population levels have remained high only in some remote areas

of the Rockies, and in northern Canada and Alaska.

The above circumstantial evidence pointed strongly toward the chlorinated hydrocarbons as the cause for the loss of the Peregrine, and several studies were made to find direct evidence from actual concentrations in the birds and eggs. The most thorough study was that of Ratcliffe for the British Trust for Ornithology. By analyzing adult specimens and eggs from throughout the British Isles, he was able to demonstrate that contamination by hydrocarbons was general, and even sub-lethal doses had an effect upon reproduction. Although Ratcliffe was unable to demonstrate the mechanism of the latter, Hickey and Anderson have since shown that contamination results in thinner eggshells, which break under the weight of the parent, and eventually the inability to form eggs at all. Ratcliffe even found a dead adult with residues as high as those that had proved lethal in laboratory experiments; evidently even adult birds could be killed outright.

But now the enthusiasm and effort that had been generated to save a bird of immense esthetic and romantic appeal ran head on into the economic interests and concerns of both farmers and chemical manufacturers. There are many men of good will and intelligence who claim that actual step-by-step proof of the lethal effect of the chlorinated hydrocarbons is lacking, and that the influence of other factors has not been sufficiently considered. This is the same type of argument that is used to discount the importance of smoking in causing lung cancer. Actually, whether the chemicals are the sole cause of the decline of the Peregrine is beside the point; they are so deeply implicated that unless their use is halted the eventual extinction of this bird and numerous other animals is certain. But here we run into the necessity of the farmer for some sort of artificial control of insect pests. There is no use invoking the lost balance of nature. Any field of grain is in itself a wholly unbalanced environment, vulnerable to the explosive increases of various pests, and without any natural protections. Pesticides are here to stay. The problem that must be solved is how to make them so specific in their actions that they will not attack the rest of wildlife and man himself. This demands political courage in controlling the use of dangerous pesticides by forcing changes by those who have made major investments in the present chemicals. We cannot expect the manufacturers to fly in the face of human nature and police themselves.

What has been done by our governments? At the federal level, virtually nothing directly, but through judicial decisions in the U.S. Court of Appeals the Secretary of Agriculture has been ordered to suspend DDT's registration within 30 days, and the Secretary of HEW was ordered to establish zero tolerance levels for DDT in human foods. The burden of proof has now been shifted to the respective Secretaries to show why this is not necessary. In Michigan, the use of DDT has been banned, and in Wisconsin it has been declared a water pollutant, which amounts to the same thing. In Massachusetts and several other states its use has been banned for special purposes such as the control of Dutch Elm Disease.

Where does this leave the Peregrine? It is too early to tell, but for the more resilient and local Osprey we can close on a more optimistic note. From the New York Times of 5 July 1970 comes the following story. On Gardiner's Island in Long Island Sound, there were 350 pairs of Ospreys in 1945; by 1966, when the use of DDT was halted on Long Island, there were only 55 pairs and only *three* young raised. This year there were 38 pairs that successfully raised 34 young, a tenfold increase over 1966. Let us hope the good work spreads.

For Further Reading

Hickey, Joseph J, editor. *Peregrine Falcon Populations.* Madison: University of Wisconsin Press, 1969.

Grossman, Mary Louise and John Hamlet. *Birds of Prey of the World.* New York: Clarkson N. Potter, Inc., 1964.

hornbill

Top, detail of a Chinese hornbill carving; center left, a mandarin belt buckle; center right, entire carving of detail shown above; lower left, a Chinese snuff bottle with carvings on sides; lower right, a spiral ear ornament from Borneo.

by Christopher C. Legge

It has been said by a noted orientalist, Dr. Schuyler Cammann, that, "Among all the strange and unusual substances that have been worked by the artists and craftsmen of Eastern Asia and the Indies, perhaps the oddest and least known is hornbill ivory. This is a dense carvable substance which is found in the solid casque that grows above the beak of the Helmeted Hornbill."

Of the many varieties of Hornbill birds—there are over sixty, all from the Eastern Hemisphere—the Helmeted Hornbill (*Rhinoplax vigil*), whose habitat is southern Malaya, Sumatra and Borneo, is the only one with a hard casque, called a "helmet," which is capable of being carved. Except for a white stomach and white bands on its tail, the Helmeted Hornbill is a dark reddish black. The bird makes a most unusual noise when flying, a noise that has been compared to the sound of an approaching train. Except in the front portion, this yellow casque is covered with a red sheath. It is this red color that makes the ivory so prized for carving. Experts believe that usually the casques were exported raw and in China, then put through a heating and

carving

pressing process. Unfortunately no detailed description survives. This process preserved and heightened the deep golden and surface red patina of the ivory.

Although there is no definite record of it being brought into China before the Ming Dynasty (1368-1644), hornbill ivory came to rival jade in the estimation of the nobility. There is a story that Yehonale, the Emperor's favorite concubine (she later became Tz'u Hsi, the Empress Dowager) once slipped out of the imperial harem and flatly refused to re-enter until a special expedition had returned with an ornament for her made of the coveted material.

Field Museum possesses several examples of Chinese carving in this medium; the most striking is a sixteenth century Ming piece. It is a skull with the front of the casque carved in high undercut relief, depicting the visit of an emperor to the fairy of the Moon. It would seem that this meeting was a terrestrial one, as shade is provided by bamboo, pine and cassia trees.

In the Museum collection there are three two-piece mandarin belt buckles carved out of hornbill ivory. Two are of the Ch'ien-Lung period (1736-95), one of which has the eight symbols of Luck carved on the front; the other depicts lions and dragons. The third is of the late Ch'ing period (about 1900) and also displays lions and dragons intricately carved. In all three, the front surfaces are part of the sheath and are consequently red. On two Chinese snuff bottles, the two narrow sides have the sheath covering and are the only parts which are carved. Here again, lions and dragons are depicted.

From Borneo, the Museum has two ear ornaments worn by men of the small Kelabit tribe, which inhabits the head waters of the Baram and Limbang River in the state of Sarawak. One is a spiral ornament with a bird's head carved at each end. The other has a curious carved design which may represent the white fangs of the Clouded Leopard. This design is popular in the ear ornaments worn by young men.

Today, hornbill ivory has lost its value in world trade, however, its usage, though limited, still exists in Borneo. In some areas where demand for the ivory was great, hunters almost brought the Helmeted Hornbill to extinction.

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BYSSUS

In the midst of the mollusks in a Museum display case are these incongruous objects: a muff, a child's cap and one glove, all in a glorious golden bronze of high sheen, finely woven of byssus *lana pinna* (fish wool), as Sicilian fishermen called it.

This silky fiber, byssus, has a curious and ancient history. Secreted by gland cells in the foot of clams belonging to a species of the family *Pinnidae,* the fiber is fine but extremely strong. The hair-like threads anchor the shell to the rocks. So firmly are they anchored that a man must use considerable force to break the fibery threads. The clams live 15 to 20 or even 30 feet below the surface of the sea.

Many other clams secrete such fibers. The tenacity of mollusk byssus is well-known in folktales. One tells about the famous bridge at Bideford, on the coast of Devon in England, that was held together by a network of byssus spun by mussels. The town council believed the masses of mussels protected the foundations from being undermined by the tide. John Watkins in his 1792 *History of Bideford* tells of the many difficulties with keeping the bridge in repair owing to the rapidity of the tide, and hints of the importance of the byssus. The "muscles" [sic] he says, which "adhere to the bottom part of the bridge are not suffered to be gathered."

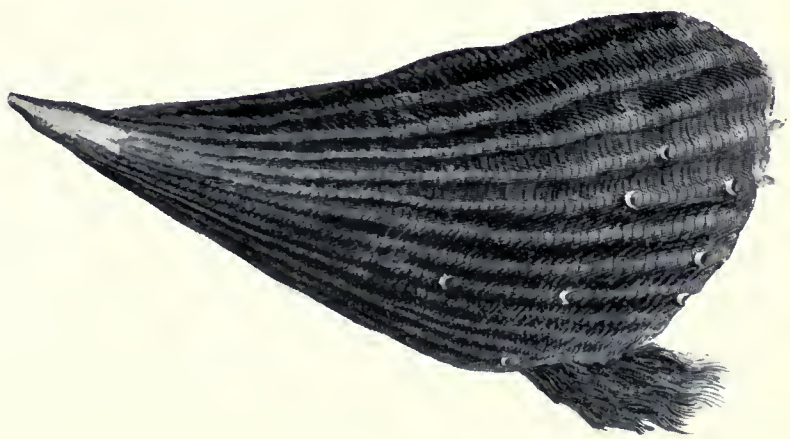
As a fiber byssus was probably first used in southern India where the business of diving for this wool of another species of *Pinna* was popular near the city of Colchi, according to the book *Periplus of the Erythrean Sea,* a document at least as late as the time of Tertullian (150-222 A.D.), who also wrote about the byssus.

From India, the use of byssus spread to Greece and other countries. The first documentation of its use in Italy at the ancient city Tarentum (Tarento) is in Tertullian. Speaking of the materials for weaving, he says:

> Nor was it enough to comb and to sow the materials for a tunic. It was necessary also to fish for one's dress. For fleeces are obtained from the sea, where shells of extraordinary size are furnished with tufts of mossy hair.

Procopius, who wrote during the Persian Wars (about 550 A.D.) tells us that the five hereditary satraps (governors) of Armenia who received their insignia from the

by Virginia M. Straub



Roman Emperor were given chlamys (or cloaks) made of the fibers of the *Pinna*. In classical antiquity, the name "byssus" was applied to linen, cotton and silk and was known to be used for garments for kings, priests and other persons of high rank or honour.

Derived from an old Egyptian word meaning "string" and "linen," Herodotus applied the word "byssus" to mummy bandages made of a kind of flax, and hence it was translated in the English Bible of 1611 as "fine linen." "There was a certain rich man, which was clothed in purple and fine linen, and fared sumptuously every day." (Luke XVI, 19).

Robert James Forbes in *Studies in Ancient Technology* (Vol IV, 1964) writes that "The best type of byssus was woven in the temple-shops as it was the ritual cloth for the gods and mummies."

There is no doubt that byssus was for the quality trade. In 1398, John de Trevisa wrote, "Thereby many manere flexe, but the fayrest of all growth in Egypte: for thereof is Bissus made ryght favre and whyte as snowe."

But what did this fine linen have to do with *lana pinna* as we know it? Today, the word "byssus" is used universally to refer to the holdfasts of bivalve mollusks, but it is interesting to reflect upon the way the meaning of the term came about. Because Teodoro Gaza, a 15th Century Greek scholar who translated Aristotle, made an error in 1470 while translating Aristotle's *Historia Animalium,* the word "byssus" was applied to the holdfast fibers of the *Pinnidae, Mytilidae, Pteriidae* and other mollusks. According to some scholars, Gaza confused the Greek word for depth, as used by Aristotle in describing the ecology of *Pinna,* with the term for the vegetable fibers. Gaza probably genuinely believed that Aristotle intended the word to be applied to the mollusk holdfast. In 1555 Rondelet in his writings perpetuated this mistake and thus the term was established.

One might appreciate that Aristotle did intend the word to be applied to the holdfast since it was similar in texture to the "fine linen" when woven, but not to the mummy bandages. Upon microscopic examination mummy bandages have proved to be made of flax.

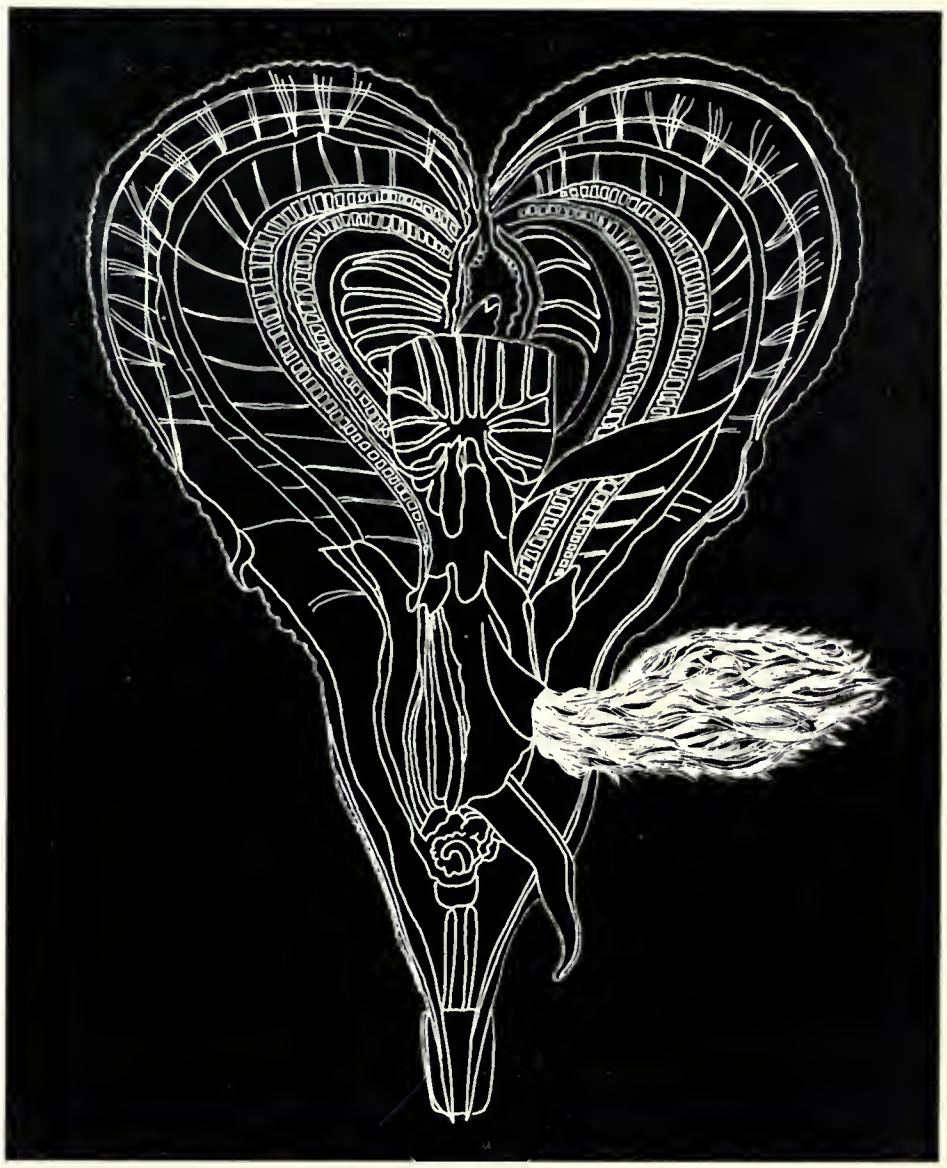
Zoologically, byssus is defined as the tuft of fine silky filament by which mollusks of the genus *Pinna* and various mussels attach themselves to the surface of rocks. The fragile, fin-shell of *Pinna nobilis* found in the Mediterranean is long and tapering, sometimes attaining a length of two feet, narrow at one end and gradually widening to considerable breadth at the other. The byssus originates from the base of the foot, which is the narrow end.

This fabulous foot can exude glue at its owner's pleasure; it then adheres the filaments to the proper place. The filaments can be reproduced after they have been cut away or damaged. P.L. Simmonds, in *The Commercial Products of the Sea* (1883), compared the mechanism in *Pinna* to that of a wire-drawer's mill:

> The *Pinna* possess a machine as incontestably mechanical as a wire-drawer's mill . . . The animal first attaches the extremity of the thread, by means of its adhesive quality, to some crag or pebble . . . when this is effected, the *Pinna,* receding . . . draws out the thread through the perforation of the extensile member by a process which Paley, In describing the similar operations of the terrestrial silkworm, justly compares to the drawing of wire. One difference alone exists: the wire is the metal unaltered, except in figure; whereas, in the forming of the thread, the nature of the substance is somewhat changed, as well as the form; for, as it exists within the water, it is merely a soft and clammy glue, the thread acquiring, most probably, its firmness and tenacity from the action of the air upon its surface at the moment of exposure.

Virginia M. Straub is Secretary to the Museum's Women's Board.

BYSSUS



There were several methods of obtaining *Pinna,* none of them easy. Diving was one of these and was described in a 1795 work by Guiseppe Saverio Poli:

> . . . *Pinna* is especially abundant on the shores of Sicily . . . grown spontaneously in large groups, and in calm water, when the shadows fall from the summit of the island, is clearly seen by persons in boats growing nearly upright and fixed in the sandy bottom at the depth of about 30 feet. There are divers, whose business it is to bring it up. But, since it cannot be loosened even by repeated blows, (for the sand firmly resists the attempts of the diver, being supported by its own weight and by the superincumbent water), in these circumstances he sits down at the bottom of the sea, brushes away with his fingers the earth which encompasses the shell, and then endeavors to pull it up by seizing it with both hands. If he is thus likely to be detained at the bottom for a longer time than he can hold his breath, he ascends to the surface, supports himself upon corks, which are in readiness for him, and, when he has sufficiently recovered himself by breathing, he again dives to the bottom to complete his task.

Another method of gathering *Pinna* was an instrument called the *pernonico,* composed of "two semi-circular bars of iron fastened at the ends, at one of which is a wooden pole, at the other a ring and cord." Fishermen would guide their boats near

where *Pinna* occurred, let down the *pernonico,* and then would loosen *Pinna* by embracing it with the iron bars and twisting it around.

The "cramp" was still another way of making *Pinna* leave home. It was described in *The Commercial Products of the Sea* as a kind of iron fork, "with perpendicular prongs 8′ in length each of them about 6″ apart, the length of the handle being in proportion to the depth of the water . . ."

After all this, it took one pound of raw wool (from 40 to 50 shells) to make but three ounces after processing. Baron Riedesel described the process at Tarentum in 1772:

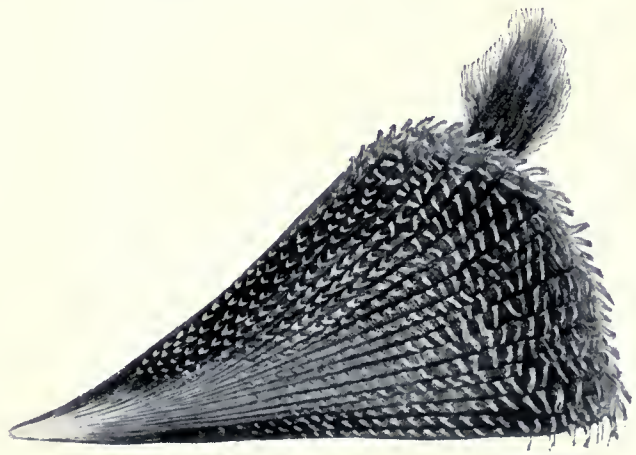
> The preparation is both laborious and ingenious, only the tips of the wool can be used and the other half is thrown away; they wash it a number of times in cold water, and dry it in the air till it is cleared of all impurities; then they comb it on a fine wire card, and last of all spin it on small spindles and knit it. Many mix it with silk by which the work gets more firmness but loses that softness and warmth which it hath naturally.

This delicate, but extremely resilient fiber, best compared to fine hair or spun glass, was greatly sought after for robes called "tarentines." It is said that the scarf of the turban of Archytas was made of byssus. In 1754, a pair of stockings of byssus was presented to Pope Benedict XV, and according to legend, due to their extreme fineness, they fit in a small snuff box. A pair of gloves could be held in a walnut shell.

Its brilliant colour, ranging from a beautiful golden yellow to a rich olive brown, prompted one writer to the supposition that ". . . byssus of the *Pinna* is said to be the Golden Fleece for which Jason sought." Whether this romantic fancy can be taken seriously is something else again, but St. Basil (370 A.D.) did admire its "golden fleece . . . which no artificial dye could imitate." Others have likened the web's beautiful yellow brown to the "burnished gold hue which adorns the backs of some splendid flies and beetles."

Despite its delicacy, the fabric woven is strong and durable, but is so attractive to moths that few ancient garments have survived.

An early English Museum-goer, John Evelyn, in 1645, found byssus worthy of note in



his listing of fascinating rarities at the Museum of Ferdinando Imperato:

> We were invited to the collection of exotic rarities in the Museum of Ferdinando Imperati, a Neopolitan nobleman, and one of the most observable palaces in the city, the repository of incomparable rarities. Amongst the natural herbals most remarkable was the Byssus marina and Pinna marina. . .

Unfortunately, the use of byssus has dwindled to but a few articles made by Italian country women for the tourist trade—mainly as curiosities—in present day Sicily and Calabria.

by Henry S. Dybas

This large orange garden spider often attracts attention in August and September because of its bright colors and attractive spider web. The web is found in gardens and open fields and is sometimes two feet in diameter. At first it is very symmetrical but soon loses its regularity because the spider must continually make repairs on its web.

The female spider sits in the center of the web on a sheet of white silk, waiting for an insect, usually a grasshopper, to blunder into the web. When a grasshopper happens to become entangled in the web, the spider rushes out and quickly covers it with a wide swath of silk produced from spinnerets near the end of its body. The spider kicks the grasshopper over several times to completely cover it and then bites through the silk and kills it.

Males are only about a fourth as large as the females. They spin their own webs but when they become mature they wander in search of the females and are then found in association with their webs. The eggs are enclosed in a pear-shaped silk sac that is fastened to vegetation. The eggs pass the winter in this sac and hatch the following year.

In spite of its large size and formidable appearance the orange garden spider is harmless to humans.

Henry S. Dybas is Associate Curator of Insects in the Department of Zoology at Field Museum.

A star

fell out

of the clouded sky

one night

to the earth below,

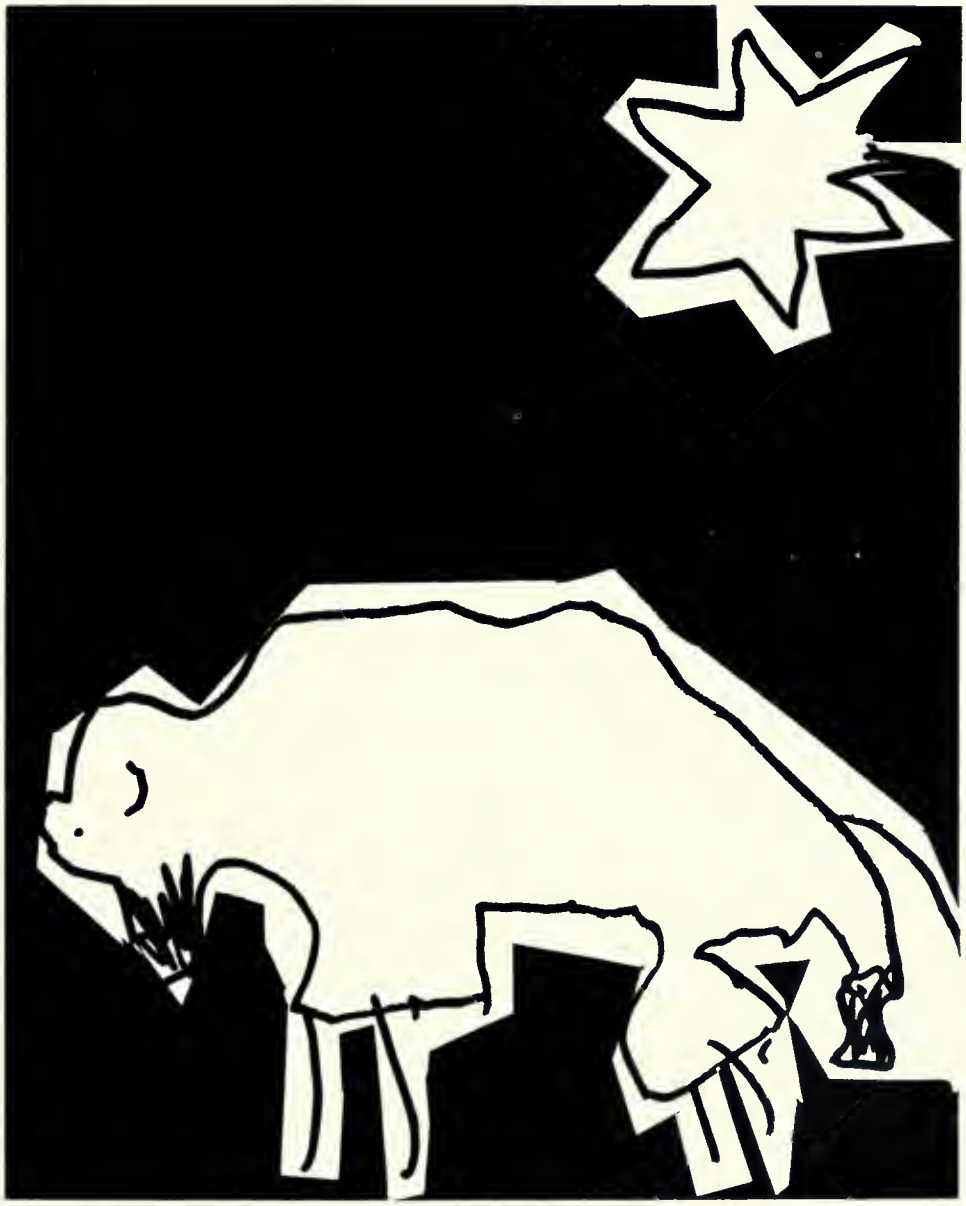
And when

he reached

the earth he found

he was

a buffalo.



The Lost Star

Blackfoot Legend

New books in the Museum's Library are reviewed by W. Peyton Fawcett, Head Librarian.

Geology of Michigan. By John A. Dorr, Jr., and Donald F. Eschman. Illustrated by Derwin Bell. Ann Arbor, The University of Michigan Press, c1970. $15.00.

This abundantly illustrated volume offers a fascinating overview of the geology of Michigan, describing the principal geologic features, explaining their origin, and portraying the geologic evolution of the state from earliest times to the present. It was written with the student and layman in mind and provides information on the origin and identification of rock and fossil specimens, Michigan collecting localities, and collection methods. Includes bibliography.

The Plant Hunters. By Tyler Whittle (Michael Sidney Tyler-Whittle). Philadelphia, Chilton Book Co., 1970. $8.95.

A comprehensive and very readable history of botanical exploration beginning with the Egyptian Queen Hatshepsut's journey to the land of Punt in 1482 B.C. Author tells why, how, and where some interesting, valuable plants (including flowers) have been collected and gives some account of their collectors. In addition he includes valuable appendices dealing with plant distribution and names and instructions for plant collecting.

The Prairie Potawatomi: Tradition and Ritual in the Twentieth Century. By Ruth Landes. Madison, The University of Wisconsin Press, 1970. $12.50.

Dr. Landes' latest volume is a study of the little-known culture of the Prairie Band of Potawatomi, descendants of a once numerous eastern woodlands tribe. She writes of the great vitality of this supposedly dying culture and the ability of its members to pracice the old beliefs and customs while adapting to a twentieth century mode of life. Her book is based on field work among the 860 members of this group in 1935-36 and 1957 and discusses, among other things, the group's Religion Dance, its preoccupation with sorcery and personal medicine, and its practice of the peyote cult.

The World of the Giant Panda. By Richard Perry. With illustrations by Wolfgang Weber. New York, Taplinger Publishing Company, 1969. $7.50.

This is the fourth volume of Perry's studies of the larger mammals; previously he has written of the tiger, the polar bear, and the walrus. In the present volume, as with the others, he is primarily concerned with the life and habits of the animals in the wild. He has drawn his information from all available records of the giant panda and has added some information of his own, based on observations of panda behavior in captivity. An interesting chapter on the attempted mating of London's Chi-Chi with Moscow's An-An in 1966 enlivens the book.

Gift Memberships

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opportunity to support natural history exploration, research and education

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Field Museum of Natural History
Roosevelt Road at Lake Shore Drive
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- ☐ $100 for associate membership
- ☐ $500 for life membership
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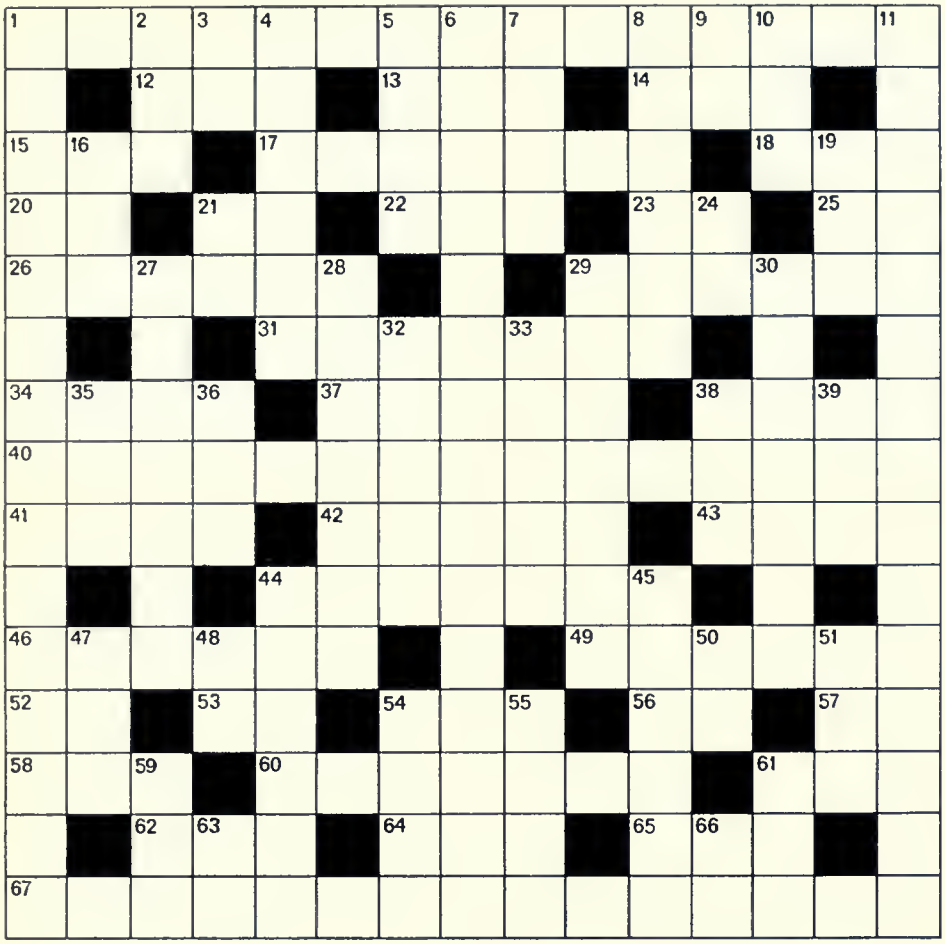

Crossword by Dr. Eugene S. Richardson, Jr.

Across

1. Curators' favorite way to acquire specimens
12. Charged particle
13. Girl's name
14. French word for "friend"
15. Tool used in collecting fishes
17. Relation in time of Cambrian to Devonian
18. Good friend
20. Expression of hesitation
21. Continent near N.A.
22. Male of species Homo sapiens
23. Phonetic sound of the 11th letter
25. Relation of Maine to Ohio
26. Branching
29. How angels feel about treading in certain places
31. Cutter of grass and puller of weeds
34. Member of the aristocracy
37. Spur spike
38. Death notice
40. Magnificently cornute sheep
41. Man's name
42. Release
43. Drag
44. Wrong purpose
46. Status of an exchanged specimen
49. Compulsive sailor
52. University extension (abbrev.)
53. Early (prefix)
54. Couple
56. Negative
57. Five hundred and one
58. Go to pot (anaerobically)
60. Where hope springs eternal
61. Announcements
62. One route to the Museum
64. Var. of syn-
65. Misthink
67. One domain of the Geology department

Down

1. Coal, iron or sand (etc.)
2. What you do on a chair
3. Early (prefix)
4. Restless or disturbed
5. Cropland
6. Rivers, lakes, canals
7. A pigment occurring in blue grapes which forms a reddish crystalline chloride (var.)
8. Make somber
9. Trade Mark (abbrev.)
10. Coarse-toothed saw
11. They know fossils
16. Unit of past time
19. Socially organized insect
21. Thus
24. Organization for alcoholics
27. Young mermaid
28. Otic warmer
29. Raptorial birds
30. Spring back
32. Celebrated fountains
33. Come together
35. Paddle
36. Doctor of Science (abbrev.)
38. Contrary (abbrev.)
39. Land of Lincoln (abbrev.)
44. Tropical African Tree
45. Relation of gold to silver
47. New (prefix)
48. You and I
50. Account of (abbrev.)
51. Out of the ordinary
54. Exam
55. Norwegian metropolis
59. Sound of disapproval
61. Rainbow
63. Titanium
66. Royal Observatory (abbrev)

Application for Fall Workshops

Saturdays in the Museum, 10:30 a.m. and 1:30 p.m. Please list the program you wish to attend in order of your preference. Sorry, only one program can be scheduled for each child.

Program Date Hour

1st choice

2nd choice

3rd choice

4th choice

Name

Address

Membership in name of

Cut along dotted line and mail to:

Raymond Foundation
Field Museum of Natural History
Roosevelt Road at Lake Shore Drive
Chicago, Illinois 60605

Children and grandchildren of Museum members will have an opportunity to meet staff members and work with specimens from the Museum's scientific collections at the seventh annual series of fall workshops for children. Designed to stimulate interest in the study of natural history, the workshops will provide small group instruction in a variety of topics for various age groups.

The programs last about one hour for younger children, and about one and one-half hours for older ones.

Make your reservation now! Each applicant is limited to one program; reservations will be accepted in the order they are received. If there is more than one child in your family who wishes to attend a workshop, please fill out an application for each child.

October 3
10:30 a.m.

Caveman to Civilization
Edith Fleming, Leader

For ages 10-13

A movie on the life of the cavemen and how they hunted prehistoric animals opens this workshop. Boys and girls will also examine actual tools used by cavemen thousands of years ago, learn how they were made and compare them with modern tools.

October 10
10:30 a.m.
1:30 p.m.

Life in an Old Dead Tree
Marie Svoboda, Leader

For ages 5-7

This program for family groups shows the different kinds of animals that might make their homes in an old dead tree and the ways in which they take advantage of the protection it offers. Parents are also invited.

October 17
10:30 a.m.

How to Build a Monster
Ernest Roscoe, Leader

For ages 9-13

This program explores the question, "How do you put together the skeleton of a prehistoric animal?" Participants will learn the basic pattern of the vertebrate skeleton and investigate the reasons for modifications of this basic plan.

October 24
10:30 a.m.

African Art and Music
Edith Fleming, Leader

For ages 10-13

Children will have the opportunity to explore African art and music. They will study African masks and each child will then make a design for a mask. After listening to a tape recording of African drum music made in Ghana, each youngster will try out a real African musical instrument and will play African rhythms in a "combo."

October 31
10:30 a.m.

Indians of Woodlands and Plains
Harriet Smith, Leader

For ages 8-11

Indian tribes developed ways of life adapted to their special environments and in doing so, showed great skill in utilizing natural materials to suit their needs. In this workshop, youngsters will handle various naturally-occurring raw materials and learn how the Indians used them in making tools, weapons and household equipment. Movies of Indian life both in the woodlands and on the western plains will be shown.

November 7
10:30 a.m.

Space Geology
Ernest Roscoe, Leader

For ages 9-13

An introduction to the rapidly expanding science of astrogeology. Beginning with a review of the relationship of the earth to the solar system and our galaxy, this program concentrates on our recently acquired knowledge of the topography, structure, and rocks of the moon.

November 14
10:30 a.m.
1:30 p.m.

Boneyard Menagerie
Ernest Roscoe, Leader

For ages 6-8 (parents are also invited)

This program looks into the world of the prehistoric relatives of many familiar animals of today, as well as some which have no close living relatives.

November 21
10:30 a.m.

Prehistoric People of Illinois
Harriet Smith, Leader

For ages 12-16

An opportunity to handle both actual prehistoric Indian tools and the raw materials from which they were made is a feature of this workshop. In addition to learning about ways these people adjusted to life in their environment, the session includes practice in identifying and sorting materials according to how they would be found at an actual "dig" and a discussion of what can, and cannot, be learned from the archaeological record.

FIELD BRIEFS

Field Trips

Three all-day field trips to local areas of geologic interest are offered this fall by the department of education. The excursions, conducted by Dr. Matthew H. Nitecki, associate curator of fossil invertebrates, are limited to adult Museum members. A preliminary meeting will be held on Saturday, September 19 at 10:30 a.m. to discuss the trips in detail.

The first trip will be to Palos Park on Saturday, September 26 to observe the results of glaciation. On Saturday, October 3, the group will go to Wilmington district to examine the ancient swamp that produced deposits of commercial coal. The final outing will be to Starved Rock on Saturday, October 17 to study various aspects of the area's geologic history. The cost of the three field trips is $25.00 per person. Interested members can contact Mrs. Dorothy Geel in the Museum's department of education.

Low Sulphur Coal

The Museum recently announced a plan to burn only low-sulphur coal beginning this fall. Although City of Chicago regulations permit the use of coal with a two percent sulphur content, the approximately 4,000 tons of coal necessary to meet the heating needs of the Museum will contain only 1.24 percent sulphur. Although this decision will result in a 64 percent annual increase in heating costs, the Museum considers the responsibility to maintain the quality of the environment an important aspect of its function in society.

Fall Lecture Series

The Museum will present the Fall Saturday Film-Lecture Series from October 3 to November 28. The free program is presented at 2:30 p.m. in the James Simpson Theatre. Films include: "Mexico South into Guatemala" by Philip Walker on October 3; "Scotland Afore Ye" by Jonathan Hagar on October 10; "Russia" by Dick Reddy on October 17; "Green Guianas" by Arthur Erickson on October 24; "Across Wilderness Canada" by Dr. John D. Bulger on October 31; "High Himalaya" by Russ Potter on November 7; "Waterbirds of the African and Asian Tropics" by Dr. M. P. Kahl on November 14; "Highlights of New England by John Roberts on November 21; and "Yugoslavia" by William Sylvester on November 28. Those attending the film-lecture will be admitted to the theatre only, without charge, at the west entrance.

New Trustees

Three Chicago-area businessmen have been elected to the Board of Trustees of Field Museum. They are Harry M. Oliver, Jr., William Searle and John Sullivan. Oliver is vice president of Marsh & McLennan. He is president of the Volunteer Agencies of Chicago, a trustee of the Old Peoples Home of the City of Chicago, a board member of the Adult Education Council of Greater Chicago, the George M. Pullman Educational Foundation and the Chicago Convention Bureau.

Harry M. Oliver, Jr.

William L. Searle

John W. Sullivan

Searle is senior vice president, general manager of the Domestic Pharmaceutical and Animal Health Divisions, for G. D. Searle Company. His father, John G. Searle, is also a trustee of Field Museum. Searle is also a director of the Children's Memorial Hospital, Lake Forest Hospital and Lake Forest Country Day School.

President and director of Skil Corporation, Sullivan is a member of the Chicago Crime Commission; the Governor's Advisory Council, State of Illinois, the Men's Financial Advisory Committee of the Junior League of Chicago and the Young Presidents' Organization, and a director of Catholic Charities.

CALENDAR

HOURS
To Labor Day (September 7)
Monday, Tuesday, Thursday
9 a.m. to 6 p.m.
Wednesday, Saturday, Sunday
9 a.m. to 8 p.m.

Beginning September 8:
9 a.m. to 5 p.m., except Friday
Friday hours through September:
9 a.m. to 9 p.m.
The Museum Library is open
9 a.m. to 4:30 p.m.
Monday through Friday

Beginning September 1:

Fall Journey for Children, "Eye" Spy, a free, self-guided tour of exhibit areas to test their powers of observation. The seasonal journeys are part of a year-round program for boys and girls who can read and write. Journey sheets available at Museum entrances. Through November 30.

Aurantia argiope, a friendly, garden-variety spider, that makes its appearance in late summer and fall, on exhibit in the South Lounge. Because of its conspicuous orange color and large size, many inquiries are received about this harmless insect at this time of year. Through October 26.

Through September 4:

Free Guided Tour and Film Program—Monday through Friday
2 p.m.: Museum "highlights" tour—Leaves North information desk
3 p.m.: "Through These Doors"—Behind the scenes at Field Museum on film—Lecture Hall

October 3:

Fall Film-Lecture Series "Mexico South into Guatemala" by Philip Walker. The colorful film journey includes Maya ruins, jungle adventure, village scenes, markets and modern city life. 2:30 p.m., James Simpson Theatre.

Continuing:

Illinois By the Sea: A Coal Age Environment, a geological exhibit, surveys Mazon Creek, Illinois and Mecca, Indiana, once located on the shores of an inland sea that occupied Central Illinois. Events that occurred at these sites 300 million years ago are graphically explored. Through October 25. Hall 9.

75th Anniversary Exhibit: A Sense of Wonder, A Sense of History, A Sense of Discovery, looks at man and his world, the history of Field Museum and some of its current research projects in a new way. Hall 3.

John James Audubon's elephant folio, "The Birds of America," on display in the North Lounge. A different page of this rare, first-edition copy is shown daily.

field museum's natural history tours

gardens
wild flowers
birds
archaeology
congenial travel companions
interpretations by experts
the unhurried approach
travel with all dimensions

GUATEMALA
LAND OF COLOR & CONTRAST
Oct. 24-Nov. 8
$1,280 includes $400 donation
Gardens at Guatemala City, Antigua, Volcan Fuego, Quezaltenango. Ruins of Tikal, Iximche, Kaminaljuyu. Chichicastenango on All Saints Day. Lake Atitlan.

THE INCA'S EMPIRE
& DARWIN'S GALAPAGOS
Two sections: Dec. 31-Jan. 29, 1971, & Feb. 4-March 5.
$2,807 includes $600 donation.
(22 days of Andes, $2,457; 11 days of Galapagos cruise & Quito, $1,190—separately) Gardens in Bogota, Lima, La Paz, Quito. Ruins of Machu Picchu, Chan Chan, Pachacamac, Cajamarquilla, Ollantaytambo, Cuzco, Lake Titicaca, Tiahuanaco. Spanish Colonial art & architecture in Colombia, Peru, Bolivia and Ecuador.

LEADER ON ALL TOURS, PHIL CLARK, former Editor of Horticulture magazine; former Garden Editor of The News, Mexico; author, "A Guide to Mexican Flora"; Field Museum Natural History Tours Chief; accompanied by Archaeologists specialized in the areas.

All donations to Field Museum are tax deductible.
Rates are from Chicago; may be adjusted from other points.

Write: Field Museum
Natural History Tours
Roosevelt Rd. at Lake Shore Dr.
Chicago, Ill. 60605

Field Museum of Natural History — Volume 41, Number 10, October 1970

BULLETIN

BULLETIN

Volume 41, Number 10
October 1970

Cover photo by Peter Bradshaw

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Field Museum of Natural History
Director, E. Leland Webber

Editor Joyce Zibro; **Associate Editor** Victoria Haider; **Staff Writer** Madge Jacobs, **Production** Russ Becker; **Photography** John Bayalis, Fred Huysmans.

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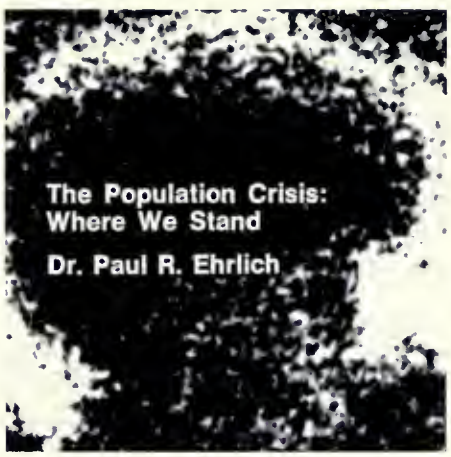
NORTH FIELD
WASTE
EAST FIELD
ARABLE
FIELDS

Among the really major issues coming up now, beyond the ones that biologists have been discussing for the last twenty or twenty-five years, two are going to be most important. First of all, is the ghetto part of the environment? If so, what is the population-environment movement going to do about it? And what should we do about it? What role, if any, should blacks take in the movement? Or is the entire movement some sort of a smokescreen to permit this country to remain racist and continue to oppress a portion of its citizens?

Another question has been raised by the Chicago Women's Liberation Union. I am 100% in favor of the goals of the group. This is another group of Americans which has been badly oppressed over a long time and is finally waking up and realizing it. I will address myself somewhat more to both of these issues later.

First, I would like to give you some general background, because I think that it is my duty as a biologist to present views of these problems of the world, where they came from, and where they are leading us. What biologists and anthropologists think of as the overall environmental problem was begun about 10,000 years ago by some small groups of people who lived in the western part of Asia. In those days, people, like Eskimos and Aborigines today, practiced intensive hunting and gathering as their way of life. They did not grow food. They wandered over the landscape and picked fruit, berries, roots, and hunted for small and large game. About 10,000 years ago, some groups of people settled down in one place and began to grow their own food. This was the beginning of the so-called Agricultural Revolution, and it was *the* most important turning point in the history of man on earth in a four million year history. Why was it so very important? Well, it did two very significant things. When people settled down in one place and grew their food, they not only had more food in general, but they also had the ability to store food; they did not have to carry it with them. They could dig a pit in the ground, line it with something, put grain in it, and then have something to eat when there was a bad harvest.

As a result of this agricultural revolution, the proportionate number of people in the population dying each year began to drop. In other words, the death rate began to decline. Fundamentally, the entire story of human population growth is a story of declining death rates.



As a model of the world demographic situation, think of the world as a glass globe, and think of a faucet being turned on into that globe as being the equivalent of the birth rate, the input into the population. Think of a drain at the base of the globe—water pouring out—as being equivalent to the output, the death rate of the human population. Think of the water in the globe as the size of the human population. At the time of the Agricultural Revolution, the faucet was turned on full blast; there was a very high birth rate. The drain was wide open; there was a very high death rate. There was a very little water in the globe, very few people in the population—only about five million. When the Agricultural Revolution took place, we began to plug the drain, cut down the death rate, and the globe began to fill up.

The second important result of the Agricultural Revolution was that for the first time we seriously began to attack the life-support systems of the planet earth. The practice of agriculture breaks down the complex and complicated ecological community and replaces it with a simple one. For instance, the first farmers in the Chicago area, who were here before the entire state was farmed, cleared away a forest, which consisted of many different kinds of plants and animals, and replaced it with a stand of a single kind of grass, corn, wheat, or some other crop. People have taken a complicated ecological system and replaced it with a simple one. Unfortunately for mankind, the stability and durability of ecological systems depends very heavily upon their complexity. So man's agricultural revolution began to destabilize the ecological systems of the planet. Those ecological systems supply us with every bit of food that we eat, and with all of the oxygen we breathe; they maintain the quality of the atmosphere and they dispose of our wastes. In other words, we depend on them absolutely for our lives.

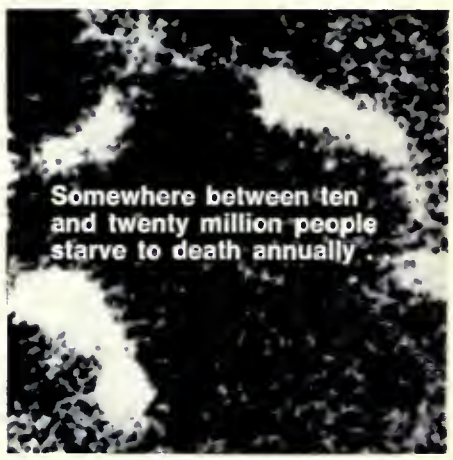
Of course, one of *the* major sources of pollution, perhaps *the* most important source worldwide, and in my estimation, the deadliest source from the point of view of destroying the capability of this planet to maintain human life (barring things like thermonuclear war), is agriculture. And the more people there are, the more agriculture we must practice. Therefore, in that sense, population growth leads inevitably to pollution.
Now, returning to the demographic side of the equation, rather than the ecological side, here is a rough history of what happened after the decline of the birth-death rate started about 10,000 years ago, about 8,000 B.C. It

took almost 10,000 years to increase the population from five million to 500 million, or half a billion. That figure was reached about 1650. Additional agricultural improvements about that time further lowered the death rate, and population growth spurted ahead more rapidly. The rate of population growth is simply a function of the difference between input and output, the difference between the birth rate and death rate. As the death rate declines, the growth rate increases. It took 200 years to double the population from one-half billion in 1650 to a billion in 1850. By that time the Industrial Revolution was well under way and the Biomedical Revolution had started. The latter is the revolution in which man attempted to attack the death rate directly by dealing with communicable disease. The death rate went down still further, the growth rate increased and the population doubled from one billion to two billion between 1850 and 1930, in just 80 years. We have not yet completed the doubling to four billion. There are right now about 3.6 billion people. If we should be very fortunate and if current trends continue, we should reach four billion around 1975. This gives us 45 years for that final doubling, although at the moment the rate of growth is about 2% at compound interest each year. If this current rate of growth, rather than the rate over the last several decades, were to continue, we would double our population size in 35 years. Now these numbers are very difficult to come to grips with. What does 3.6 billion anything mean to anybody? Very little, you just cannot picture it.

What can I tell you about 3.6 billion people on the face of the earth? According to any calculations we have been able to make, that is somewhere between three to seven times more people than this planet can permanently support. You say, how can that be? How can we possibly have seven times more people than the planet can permanently support? The answer is very simple. We are supporting those people today, doing a miserable job for about half of them, by doing something that very few businessmen would do in the course of their own businesses: burning our capital. We are destroying and dispersing resources that exist in a rather small and finite supply. For instance, we are consuming the fossil fuels which accumulated in the earth's crust over hundreds of millions of years. We will essentially destroy every bit of fossil fuel on the surface of the earth in a period of 200 or 300 years. It is a process which David Brower calls, quite accurately, "grand larceny against the future." We are stealing resources from our children. I might

point out that the United States and many other overdeveloped countries are also stealing from their fellow inhabitants of the earth by taking much more than their share of these resources.

We are already wildly overpopulated, by any standard that you wish to adopt. But that is not the worst of it, because we have that 2% growth rate. A 2% growth rate operating on 3.6 billion people a year means that we are adding 70 million people annually to the globe. That means every three years there is another equivalent of the United States to feed, house, and care for on the surface of the earth. To view it by another statistic, in all the wars that the United States has fought, from the Revolution through Laos and Cambodia, we have had roughly 600,000 men killed in battle. The world population is growing so fast that that number of deaths is made up every three and one-half days.



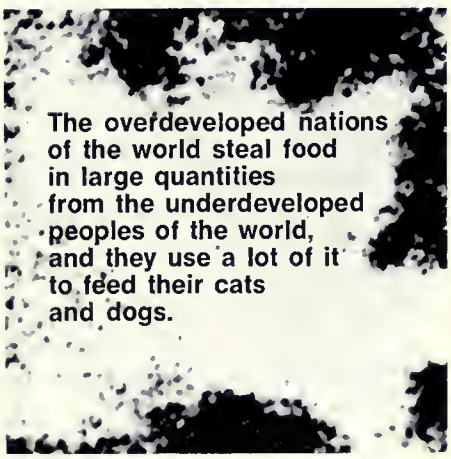
What about the food problem? Almost half the people in the world are hungry in one sense or another. Either they are undernourished, that is, they do not get enough calories, or they are malnourished, usually meaning they do not get enough high quality protein. Somewhere between ten and twenty million people starve to death annually now, and the trend is all downhill.

Those gruesome statistics are going to change for the worse, essentially on a continuous basis from now on. Of

course, as we try desperately to grow more and more food to feed this burgeoning population, the problems of environmental deterioration, the disruption of the life-support systems upon which *all* of us depend—black, white, green, yellow, male, female—will be beyond repair. Then we will be in very bad shape.

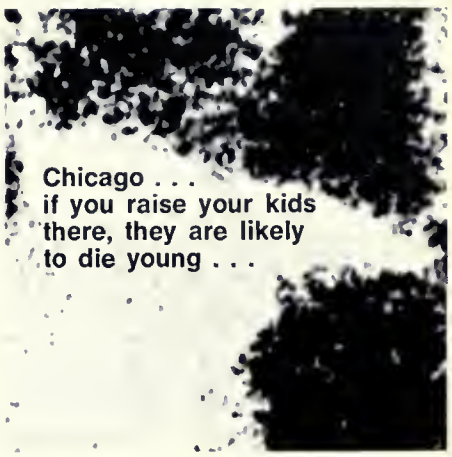
The food situation is desperate. It is going to get more desperate. Do not be fooled by stories about food surpluses, which you may have read in the newspapers. These will show you where the economic head of the world is. This is not surplus in the sense that there is more food than people can eat; this is more food than people can *buy*. If you read the literature of agricultural economics, you will find such statements as the way to prevent people from starving in the world is to "create more demand" for food. What they mean by demand is *money*. Curiously enough, people who are starving to death usually do not have very big bankrolls.

So we have a desperate world food situation. I wish that the entire situation could be discussed rationally just in terms of too many people and too little food. But it is much more complex than that; there is too little food in two senses. First of all, there is too little food in an absolute sense. If the food were divided up evenly among all the nations of the world and among the people within countries, everybody would have just about enough calories. Calories are not a problem; we can always supply more. But everybody would be protein malnourished, which is a great problem, because protein is expensive, both economically and ecologically. The second part of the world food problem is that the food does not come close to being divided up equally, just as nothing else in the world comes close to being divided up equally. The overdeveloped nations of the world steal food in large quantities from the underdeveloped peoples of the world, and they use a lot of it to feed their cats and dogs.



Unfortunately, though, the whole problem cannot be considered only in the context of food and people. Overlying the whole situation is the problem of environmental deterioration. If you talk to the average layman about environmental deterioration, he is likely to think of the problem in terms of pollution. This is a serious mistake, but a common one. He is also likely to talk in terms of smog which burns his eyes and funny things that are floating around in the water that he would like either to swim in or drink.

Environmental deterioration is often viewed largely as an aesthetic problem, which indeed it is. If the layman is relatively well read, he will also know that pollution is something that kills him stone cold dead. If you raise your children in Los Angeles, California, or Chicago, Illinois, statistically you are killing them off early. If you raise your



kids there, they are likely to die young of emphysema, cardiovascular disease, or some exotic cancer, because the air that they breathe contains something beyond that mixture of oxygen and nitrogen that we evolved to breathe. It contains a mixture of exotic poisons, thanks to your local power company, the automobiles that you drive, and so on. There is no question whatsoever that this means you will die young, and there is abundant data to show it.

If you are a human being anywhere on the earth, particularly in the United States, Israel, or India, and particularly if you are black or brown, you are also going to die young because you carry in your body a load of those very long-lived pesticides, chlorinated hydrocarbons, particularly DDT. The average DDT load in the United States is about 12 parts per million. We do not know yet how many years that will knock off your life expectancy. But if you were born since 1948, you have had that kind of load in you since you were conceived. We now know that DDT crosses fetal membranes, so a fetus in the womb is picking up DDT from its mother. It is quite likely from the other data that are beginning to

appear that you have already lost 10 or 20 years off your life expectancy; we will not find out for a while. But, after all, that would be a small price to pay for keeping the profits of the petrochemical industry high, which is the only real benefit from the production of DDT and similar chemicals.

We will all die young because of what we have been doing to the environment. From the point of view of our species, a short life expectancy is not all that important, because for most of the approximately four million years of our existence, mankind got along with a life expectancy of roughly 25 or 30 years. That was fine, because, of course, people may have died young, but not before they had reproduced. The species could go on.

Unfortunately, there is still something to worry about. Even if we all live only to be 30, we will still have gross problems. The most serious effect of pollution is not a shortened life expectancy. The really important aspect of environmental deterioration, and pollution in particular, is that it assaults the ecological systems upon which we depend absolutely for our food. Fundamentally, we are destabilizing these systems with the poisons that we add to the planet. Although you might live to be 35 with a heavy load of DDT in your tissues, maybe even to 45; if you are 20 now, you will not live to see 21 if we should turn off the photosynthetic process on the planet. Remember, those ecological systems give us all of our food, and photosynthesis is the basic process that produces it. If we turn it off, that is the end of the ball game.

We do not have to worry about oxygen right away. It is true that the ecological systems supply us with our oxygen too, but they have already built up a very large supply in the atmosphere. If we were to turn off the photosynthetics process (the process by which green plants, using energy from the sun, put together food molecules and in the process give off oxygen) tomorrow, there would be enough oxygen around to sustain us for about 1000 years, before we would die of suffocation. But we would also have turned off the food production. We would die of starvation about 999 years before we would suffocate!

Pollution is a very grim problem, and the grimmest part is that which is least recognized—the subtle assault on the ecological systems of the planet. Here is one more example of this kind of subtle effect. There is now a permanent veil of air pollution over the entire planet. The sources of this pollution vary. The most important single source is haze from agricultural dust, most of it from underdeveloped countries, but a large amount of it from overdeveloped countries as well. Again we are back to the people-polluting problem. Why do we have so much agriculture? Because we have so many people. Here is a direct link between the number of people and the amount of pollution. This atmospheric haze comes largely (over 50%) from agriculture, but, of course, there are major components from industry and automobiles as well. It is so bad now that the turbidity, the dustiness, of the atmosphere over the central Pacific, far from any sources of pollution, has increased by 30% over the last decade. The net effect of this at the moment is to cool the earth. When the earth is cooled, the weather changes. When the weather changes, agriculture suffers.

We are about to see some dramatic weather changes in the United States in the next decade, weather changes which some meteorologists believe may be bad enough to throw us into a food crisis right here in the U.S.A. We could be a single volcanic explosion away from the end of civilization. A volcanic explosion equivalent to the explosion of Tambora in 1815 could wipe out agricultural production for a full year over much of the world.

There are some other threats to our existence which are fundamentally environmental. One is the problem of worldwide plague; we just missed in 1967. We could have lost three-fourths of the people in the world. The potential is still there. And, of course, since the world's resources are finite and the number of people is growing, the per capita slice of the resources is continually shrinking. That, according to our political scientists, is a major push towards international conflict. We are in grave danger of starting a thermonuclear war. If you consider the ecological aftermath of a thermonuclear war, there is only one conclusion—that there will be no civilization afterwards, at least, not in the northern hemisphere.

In regard to the two problems that I discussed before, I would like to deal with them in the context of what we can do, rather than what the problems are, except to mention urbanization. This is a very important part of what builds ghettos. In discussing solutions to the world's problems, it is necessary to consider what is going to happen to ghettos and what new ghettos might

develop. The urbanization problem is so severe over the world today—cities are growing so rapidly—that some really preposterous statistics can be generated. The one I remember best is that, if today's trends continue by 2050 everyone will live in a city of a million or more, and there will be cities of more than a billion people. Needless to say, those trends will not continue.

Here is a single example from outside the United States of how we can make very silly mistakes in trying to solve our problems, if we do not consider urbanization. Right now, an attempt is being made to export our incompetent agricultural technology from this country to some of the underdeveloped countries. This effort is called the Green Revolution. If some people have their way, we will attempt to mechanize the agriculture of the Indian subcontinent. If Indian agriculture were mechanized, it would finish off Indian cities. The fundamental reason that we have such a severe urban problem in this country, of course, is that American agriculture is mechanized. People were forced off the land, and when people are forced off the land, they move into cities. India already has ghastly urban problems, much worse than ours, difficult as that is to picture. But today, only 20% of Indians live in cities. By contrast something like 70% of Americans live in cities. If the vast mass of Indian peasants is forced off the land, Indian cities will simply dissolve, they will be destroyed.

If we want to improve India's agriculture, and we certainly want to do that, we must help them design a system which results not only in high productivity, and is ecologically sensible, but one which is also labor intensive. It must still be possible for Indians to make their living on the land without being forced into the cities where there is nothing for them to do.

Now, what might be done about our problems? Before discussing anything in detail, let me first give you a broad outline of what must be done on a global scale. First of all, we must have population control. This must start with groups where population growth is most serious, namely among affluent white Americans, Russians, Europeans, and Japanese. These are the people

who are looting and polluting the world. Second, there must be some sort of change in the world economic system. I usually describe it as a problem of de-developing the overdeveloped countries and semi-developing the underdeveloped countries. It boils down to a redistribution of the resources of the world and a change in the world trade system, so that all countries of the world have reasonable access to the riches of the world and are not exploited by one country or another.

You may say, that sounds like a terrible communist plot. Actually, it is not, because the overdeveloped countries include both communist and capitalist nations, and the pattern of exploitation is common to both systems. Unfortunately, or perhaps fortunately, there is no way we can survive on our little spaceship earth without everybody having a fair chance, because the capability of blowing up the entire ship really rests in everybody's hands. There simply is no choice but to have population control, de-development and semi-development, *and* to develop an ecologically rational way of dealing with industry, agriculture, and so on.

There is no question whatsoever that there will not be 7 billion people on the planet by the year 2000. The only question that remains is *why* there will not be 7 billion people in the year 2000. There are fundamentally two choices here: one can be that we have managed to bring the birth rate down rather rapidly, to slow down the input to the population. The other will be that we have elected the "animal" solution to the problem; that is, let the death rate rise again. Whenever an animal population overreaches its environment, overstresses its resources, it simply dies off, or dies back to a very low level. Only the human population has available to it one other alternative—to limit the input into the population and reduce its size that way.

If we are going to solve the world's problems, we must unquestionably consider racism and war among them. This means eliminating things like ghettos, Viet Nam, and so forth. There is absolutely no way to live on a little spaceship with limited resources, with some people in steerage or third class, with the people in the first class cabins stealing food from the people in the third class cabins, waving large bombs at them, and expect them to sit still for it. There is no way to get the United States turned around and cleaning up its mess, as long as a large portion of its citizens are forced to live in hideous slums and to do without the rights which we have in theory guaranteed them in our constitution, but which we have systematically denied them.

There is no way to solve the world's problems unless we take advantage of the intelligence present in the human

population. One of the major reasons why one ought to be wildly in favor of women's liberation is that as a society we have very busily neglected what is fundamentally one-half of our talent. For instance, there is a tremendous shortage of physicians in this country. One reason that the U.S. has about the lousiest medical care of any overdeveloped nation is that we do not have enough physicians. The medical schools cry about there not being enough physicians, and at the same time they have very strict quotas on how many women they will admit. In the Soviet Union, 70% of the physicians are women, and their public health system is excellent. This is just one example of how we fail to use the talent in our country.

Similarly, we do not use the talents present in our black population, in our Chicano population, and our Indian population. Indeed, we do not use the talent that exists in our poor white population, which numerically, though not percentage-wise, is even larger than the poor black population. As a nation we are faced with immense difficulties, and instead of taking advantage of the talents that could be used to help us out of these difficulties, we are busy running a racist country, electing people who will continue with racist policies.

There is a difference between family planning and population control. When you plan your family you do something which has long been socially acceptable. The idea is not to have more children than you want; surely nobody thinks that we ought to bring unwanted children into the world. It is a fine idea to have the number of children you can support. I think everybody is in favor of family planning. What we are trying to introduce into the world is a new ethic that goes beyond family planning. This says yes, you should plan your family; but when you plan your family you must think about the size of your society's population as a whole, what society can manage to support, and what kind of a world we are going to have. When you plan your family, you have to think, not only about your ego and the number of children you would like to have, but what kind of a world those children will grow up in, what kind of a life they will have, and what kind of chance they will have to plan their own families. In other words, we are trying to move away from the idea that quantity is the prime thing to think about in childbearing and to encourage the idea that quality is what should be emphasized, the quality of our children and of the world in which those children are going to live. I think that in this country it is quite possible to bring about population control—for society as a whole to think about and to regulate the size of its population for its own benefit and for the benefit of everybody in the society—with no form of coercion whatsoever. Fundamentally, all we really need to do is to take the pressure off women to have children. Right now we pressure people into marriage and we pressure couples into having children. Probably, in our society, removing that pressure would be enough.

The problem of de-developing the United States, in moving from our present "cowboy economy," which emphasizes production, consumption and waste, to a "spaceman society," which emphasizes the high quality of everything and the recycling of

everything, is considerably more difficult. But I think it can be achieved, if we are willing to take political action. If we are going to succeed in this country, it is my opinion that the people must take back the political system from the pressure groups. We can no longer afford a government which is not interested in doing anything for the people. We can no longer afford a government which is not willing to face up to the problems of the country. We can no longer afford a government which is working very hard in Southeast Asia to delegate the killing to another group, while maintaining our resource position over there, come hell or high water. We must have a government made up of people who want to solve the world's problems and the problems of the United States. The only way we can achieve that is for people to get out and work very hard politically.

I am not surprised to see that there are relatively few blacks in this audience. I feel that people ought to work in the areas of their own greatest concern. A lot of people have been disappointed that environmental congresses have not been attended by more blacks and that more blacks have not been interested. Well, I do not think blacks should be

interested in this kind of congress. They have their own environmental problems which are extremely serious. This also applies to Chicanos, American Indians, Oriental Americans, and indeed to many women. They have their own part of the environmental problem to take care of. I think that all blacks should be engaged as fully as possible in getting changes that will remove ghettos, give blacks a good chance at a decent education, a decent social position, and economic security. From my own personal point of view, there is no point in whites saying anything to blacks about controlling the size of their families. The first reason is that the whites are the ones who are doing the looting and polluting of the globe, not the blacks. The blacks are much more often the victims of pollution, both the kind of pollution we find in the ghettos, and the kind of pollution we find in our food. They, for instance, have higher DDT loads than whites do. I see no reason why any black should listen to advice from any white until he has in our society precisely the same educational, social, economic and political opportunities.

If there are any racists in the audience who are worried about having too many black children in the world, I have an answer for you. It is quite true that poor blacks have a somewhat higher birth rate than poor whites. It is also true that affluent blacks have a somewhat lower birth rate than affluent whites, although of course because of our society the proportion of affluent blacks is much smaller. But if we give the blacks their full rights in this country, their birth rate will unquestionably become indistinguishable from the white birth rate. We can go about designing a country for everyone. But you cannot expect people to participate with you in saving a world of which they do not have a fair slice. They are just not interested and they are not going to be interested. The same goes for other people who are not treated fairly in our society.

We have a very difficult task ahead of us. I wish I were enormously hopeful that we will get the job done; I am not. I think the only hope we have is to get out and work very, very hard and then perhaps we will. But fundamentally it is up to you, and I wish you luck.

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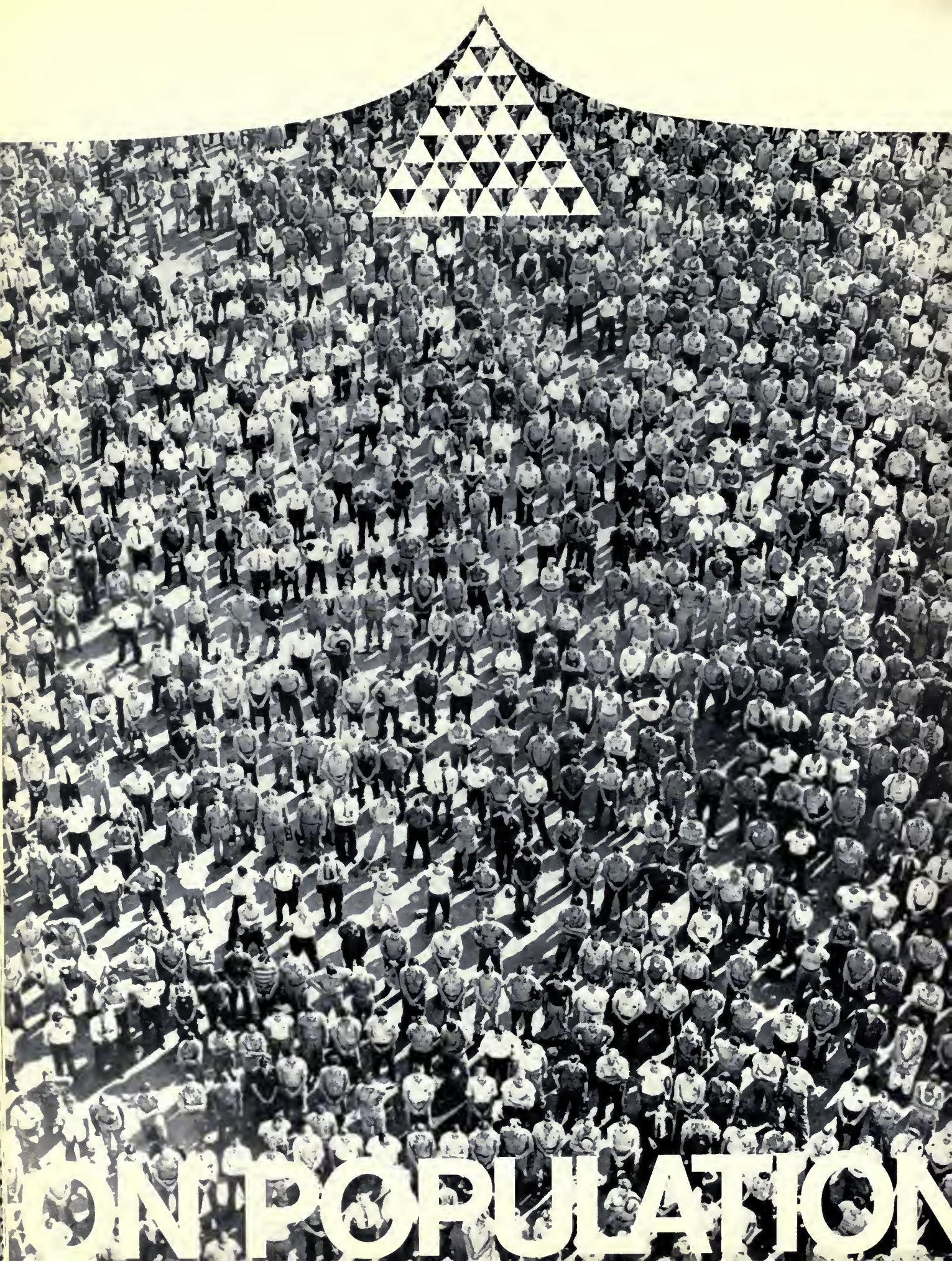
Dr. Paul R. Ehrlich is Professor of Biology at Stanford University. He is the author of *Population Bomb* and *Population, Resources, Environment: Issues in Human Ecology,* which is reviewed on page 14.

The article which appears above was an address Dr. Ehrlich delivered before the First National Congress on Population and Environment on June 11, 1970 in Chicago. The address appears in print here tor the first time. Excerpts from this address and others delivered to the Congress will appear in a paperback book to be published by McGraw Hill in the late fall.

Photos on page 2 from Historical Pictures Service and United Press International.


ON POPULATION

"The men of old did not till the field, for the fruits of plants and trees were sufficient for food. Nor did the women weave, for the skins of birds and animals were enough for clothing. Without working there was enough to live, there were few people and plenty of supplies, and therefore the people did not quarrel. Hence neither large rewards nor heavy punishments were used, and the people were naturally in good order. But nowadays people do not consider a family of five children as large, and, each child having again five children, before the death of the grandfather there may be twenty-five grandchildren. The result is that there are many people and few supplies, and that one has to work hard for a meagre return. So the people fall to quarrelling, and though rewards may be doubled and punishments heaped up, one does not escape from disorder."

Han Fei-Tzu (Chou Dynasty, died 233 B.C.)

"The strongest witness is the vast population of the earth to which we are a burden and she scarcely can provide for our needs; as our demands grow greater, our complaints against nature's inadequacy are heard by all. The scourges of pestilence, famine, wars, and earthquakes have come to be regarded as a blessing to overcrowded nations, since they serve to prune away the luxuriant growth of the human race."

Tertullian (ca. 160-230) in *De Anima*

It may be surprising to persons in the 20th century that their concern about overpopulation is not a new one. Scholars, many centuries before Christ, and in all parts of the world, discoursed on the problem of overpopulation. But not until the late 18th and the early 19th centuries were scholars systematically analyzing the overpopulation problem, and graphically portraying its consequences. One of the most articulate of population theorists was Thomas Robert Malthus (1766-1834), an English economist and sociologist. Malthus' theories covered a wide range of overpopulation problems; and it has since been shown that not everything Malthus said was true. But Malthus' influence on scientists of his time, including Darwin, is profound. Malthus is often credited with influencing Darwin's theory of natural selection.

The following excerpts from Malthus' work are taken from the original 1803 An Essay on the Principle of Population, or, A View of its Past and Present Effects on Human Happiness, *which is a greatly expanded version of his 1798 essay on overpopulation.*

. . . But as, by that law of our nature which makes food necessary to the life of man, population can never actually increase beyond the lowest nourishment capable of supporting it; a strong check on population, from the difficulty of acquiring food, must be constantly in operation. This difficulty must fall somewhere; and must necessarily be severely felt in some or other of the various forms of misery, or the fear of misery, by a large portion of mankind.

. . . we will take the slowest of these rates of [population] increase; a rate, in which all concurring testimonies agree, and which has been repeatedly ascertained to be from procreation only. It may safely be pronounced therefore, that population when unchecked goes on doubling itself every twenty-five years, or increases in a geometrical ratio.

The rate according to which the productions of the earth may be supposed to increase, it will not be so easy to determine. Of this, however, we may be perfectly certain, that the ratio of their increase must be totally of a different nature from the ratio of the increase of population. A thousand millions are just as easily doubled every twenty-five years by the power of population as a thousand. But the food to support the increase from the greater number will by no means be obtained with the same facility. Man is necessarily confined in room. When acre has been added to acre till all the fertile land is occupied, the yearly increase of food must depend upon the amelioration of the land already in possession. This is a stream, which, from the nature of all soils, instead of increasing must be gradually diminishing. But population, could it be supplied with food, would go on with unexhausted vigour; and the increase of one period would furnish the power of a greater increase the next, and this, without any limit.

. . . If America continue increasing, which she certainly will do, though not with the same rapidity as formerly, the Indians will be driven further and further back into the country, till the whole race is ultimately exterminated.

. . . The necessary effects of these two different rates of [population and production] increase, when brought together, will be very striking. Let us call the population of this island eleven millions; and suppose the present produce equal to the easy support of such a number. In the first twenty-five years the population would be twenty-two millions, and the food being also doubled, the means of subsistence would be equal to this increase. In the next twenty-five years, the population would be forty-four millions, and the means of subsistence only equal to the support of thirty-three millions. In the next period the population would be eighty-eight millions, and the means of subsistence just equal to the support of half that number. And at the conclusion of the first century, the population would be a hundred and seventy-six millions, and the means of subsistence only equal to the support of fifty-five millions; leaving a population of a hundred and twenty-one millions totally unprovided for.

Taking the whole earth instead of this island, . . . supposing the present population equal to a thousand millions, the human species would increase as the numbers 1, 2, 4, 8, 16, 32, 64, 128, 256, and subsistence as 1, 2, 3, 4, 5, 6, 7, 8, 9. In two centuries the population would be to the means of subsistence as 256 to 9; in three centuries as 4096 to 13, and in two

thousand years the difference would be almost incalculable.

In this supposition no limits whatever are placed to the produce of the earth. It may increase forever and be greater than any assignable quantity; yet still the power of population being in every period so much superior, the increase of the human species can only be kept down to the level of the means of subsistence by the constant operation of the strong law of necessity acting as a check upon the greater power . . .

. . . The power of the earth to produce subsistence is certainly not unlimited, but it is strictly speaking indefinite, that is, its limits are not defined, and the time will probably never arrive when we shall be able to say, that no farther labour or ingenuity of man could make further additions to it. But the power of obtaining an additional quantity of food from the earth by proper management, and in a certain time, has the most remote relation imaginable to the power of keeping pace with an unrestricted increase of population . . .

. . . If it be really true, that without a diminished proportion of births we cannot attain any *permanent* improvement in the health and happiness of the mass of the people, and secure that description of population, which, by containing a larger share of adults is best calculated to create fresh resources, and consequently to encourage a continued increase of efficient population, it is surely of the highest importance that this should be known . . .

. . . The preventive check is peculiar to man, and arises from that distinctive superiority in his reasoning faculties, which enables him to calculate distant consequences. Plants and animals have apparently no doubts about the future support of their offspring. The checks to their indefinite increase, therefore, are all positive. But man cannot look around him, and see the distress which frequently presses upon those who have large families; he cannot contemplate his present possessions or earnings, which he now nearly consumes himself, and calculate the amount of each share, when with very little addition they must be divided, perhaps, among seven or eight, without feeling a doubt; whether if he follow the bent of his inclinations, he may be able to support the offspring which he will probably bring into the world . . . Will he not lower his rank in life, and be obliged to give up in great measure his former society? Does any mode of employment present itself by which he may reasonably hope to maintain a family? Will he not at any rate subject himself to greater difficulties, and more severe labour than in his single state? Will he not be unable to transmit to his children the same advantages of education and improvement that he had himself possessed? Does he even feel secure that, should he have a large family, his utmost exertions can save them from rags, and squalid poverty, and their consequent degradation in the community? And may he not be reduced to the grating necessity of forfeiting his independence, and of being obliged to the sparing hand of charity for support? . . .

. . . The positive checks to population are extremely various, and include every cause, whether arising from vice or misery, which in any degree contributes to shorten the natural duration of human life. Under this head therefore may be enumerated, all unwholesome occupations, severe labour and exposure to the seasons, extreme poverty, bad nursing of children, great towns, excesses of all kinds, the whole train of common diseases and epidemics, wars, pestilence, plague, and famine . . .

. . . In a country whose resources will not permanently admit of an increase of population more rapid than the existing rate, no improvement in the condition of the people which would tend to diminish mortality could *possibly* take place without being accompanied by a smaller proportion of births . . .

fall color

by Dr. William C. Burger

One of the most spectacular sights that nature has to offer is the spectacle of fall color. This is found only in those broad-leaved trees and shrubs that lose their leaves as the cold season approaches. These plants "sense" approaching cold weather not by temperature but by the shortening of day-length in late summer. Preparations must be made in advance —the leaves cannot just fall off.

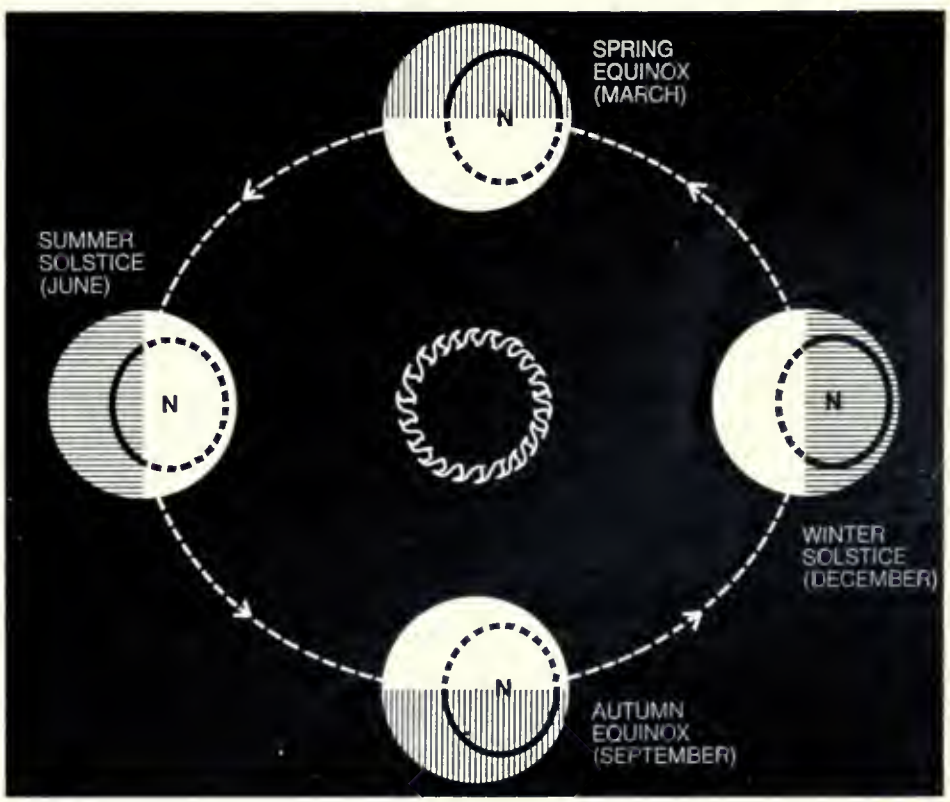
An abscission layer must first be formed at the base of the leaf-stalk. This abscission layer will allow the leaf to break off easily and it will seal off the small veins that carried water and nutrients in and out of the leaf. These veins must be sealed off to prevent water-loss and invasion by fungus or insects. As the abscission layer is formed the leaf continues to produce sugars which now, unable to leave the leaf, build up in concentration. This build-up of sugars is, in part, responsible for the production of anthocyanin pigments, which produce the dark reds and purplish colors. There are yellow pigments also present in the leaf. These are usually hidden by the bright green of chlorophyll in summer. As chlorophyll breaks down in early fall, these carotenoid pigments become visible and produce the yellow and orange colors of fall.

There are other factors contributing to the presence and intensity of fall color in a given plant. Heredity is very important. Some species produce deep brilliant reds such as the sour gum (*Hyssa*) and sugar maple, others bright yellow as in the tulip tree (*Liriodendron*). Light itself can play a role. Leaves in bright light often exhibit more intense colors than those in the shade. And, in addition, some people claim that cool weather is important. However, frost can cause the leaves to turn brown more quickly. Damaged branches or trees often turn color early.

There are only a few areas in the world where fall color gives a truly spectacular display. These areas are the northeastern United States and adjacent Canada and northeastern Asia. The reasons for this are several. Both these areas have broad-leaved forests with many different kinds of trees giving a great variety of colors. Another reason is the tendency for the weather to be clear and cool in late September. In Europe the weather is often cloudy and not as cold at this time—and the colors are usually much less intense. We are lucky to be so close to one of the best areas for seeing the display of fall color.

Fall color begins at first in the north and then "travels" south. In northernmost Wisconsin and adjacent Michigan the first week of October is usually the peak of color-intensity. Coming southward, the second week of October is usually best for central and southern Wisconsin, and the last two weeks of October for Illinois and Indiana. The color show can vary greatly from year to year—depending on conditions. Let's hope that this will be a good year—and if it is, don't miss it!

Dr. William C. Burger is Assistant Curator, Vascular Plants in the Department of Botany at Field Museum.



This diagrammatical representation shows the relationship of the earth to the sun at each of the four seasons. The seasons are caused by the 23° 27' degree tilt of its axis (relative to the plane of the earth's orbit), and the revolution of the earth around the sun. The North Pole points toward the sun at the summer solstice (around June 22), but away from the sun at winter solstice (around December 22). The angle at which the sun's rays strike the earth is critical in determining the earth's seasonal changes in temperature. At the spring and autumn equinoxes the length of the day (represented by the dashed line) is equal to the length of the night (solid line). Plants, sensing approaching cold weather by the shortening of the day-length in late summer, start making preparations for the fall.

Population, Resources, Environment: Issues in Human Ecology

by Paul R. Ehrlich and Anne H. Ehrlich
San Francisco, W. H. Freeman and Company, 1970 ($8.95)

This book was designed by the authors to provide a "reasonably comprehensive and reliable sourcebook for the study of questions relating to population, resources and environment" and was written for the layman as well as teachers and students. The Ehrlichs believe that our earth is already grossly overpopulated and that the upper limit of food production by conventional means has very nearly been reached. Ten to twenty million people are starving to death every year and further attempts to increase food production will only tend to accelerate the deterioration of the environment and result in a reduction of the earth's capacity to produce food. They argue that this situation and the rate of population growth may result in worldwide war and/or disease unless efforts are made now for population control.

As a general reader, with small competence in many of the areas discussed, I cannot review the facts used by the authors in illustrating their theses. I can say, however, that the book is well-written and documented and that the facts are presented clearly, thoughtfully, and calmly. The Ehrlichs' aim is to convince us of the nature and scope of the present crisis, not to frighten us, and they have succeeded admirably.

Implicit in the writing of the book is the belief that these problems can be solved. But their solution will require rapid and dramatic changes in our attitudes, "especially those relating to reproductive behavior, economic growth, technology, the environment, and conflict resolution." Some of the authors' recommendations seem, as they point out, unrealistic; I very much doubt, for example, that a program to "de-develop the United States" has much chance of success. However, something must be done if our civilization and species are to survive and this book can do much to focus our attentions on these problems. It should have the widest possible distribution.

by W. Peyton Fawcett, head librarian, Field Museum

Animals in Migration

by Robert T. Orr
Macmillan Co., New York, 1970 ($12.50)

Animals in Migration attempts to cover all aspects of migration, causes, movements and mechanics, for all forms of animal life. Dr. Orr is to be congratulated on how well he achieved his objective in a scant 300 pages. While no one subject is covered in any depth, he does provide an introduction to a wide range of knowledge.

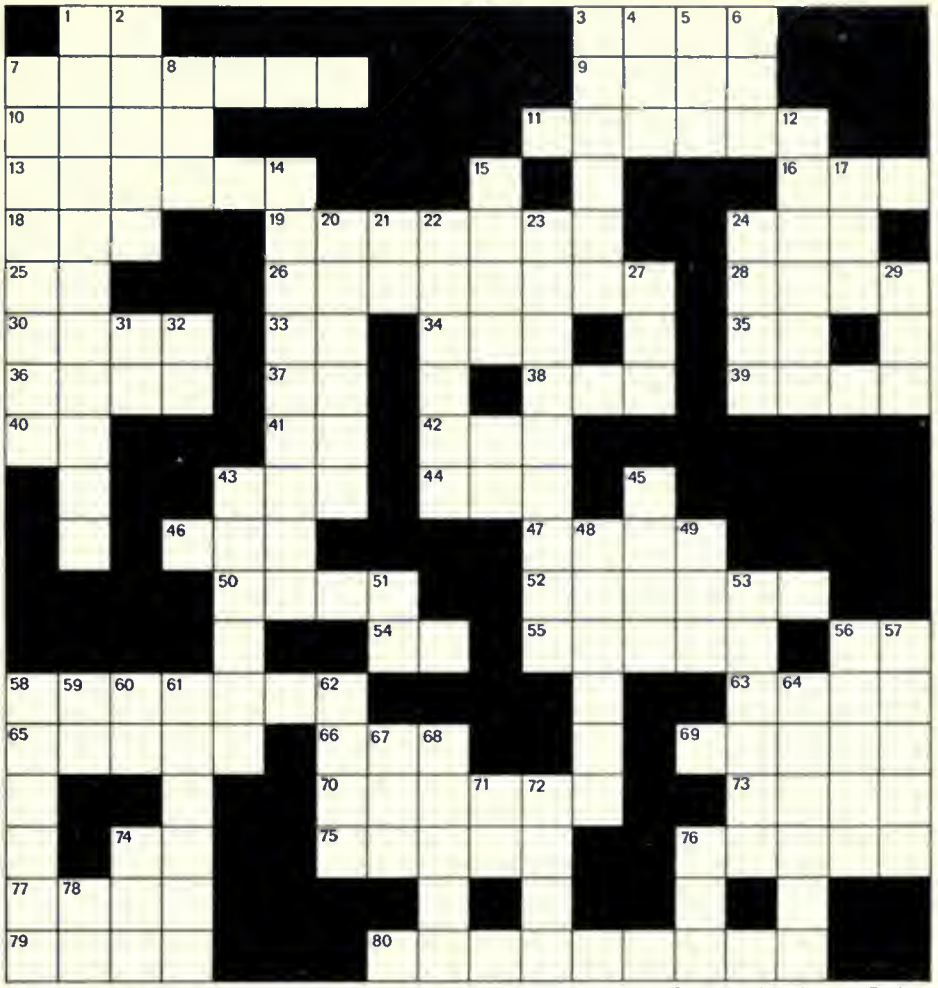
Dr. Orr begins his book with a general discussion of animal population movements, not all of which can be called migrations, and then goes on to discuss the reasons for migration within the economy of the organism, the influence of environment, and the physiological features. He follows this with the migration patterns of selected species from most of the better known animal groups, insects, fishes, amphibians, reptiles, birds and mammals. The preponderance of these reports are taken from the birds, which have always been the best known and most studied class, but most readers will be surprised to find out how many species of other groups also perform extensive migrations. He concludes with chapters on orientation, hazards, and the problems of observing and studying migration.

This is a difficult book to quote from, or rather a difficult book to stop quoting from. Dr. Orr not only includes the classic examples of bird migration, such as the Arctic Tern, that nests in the North American arctic, migrates down the east side of the Atlantic to winter in south polar seas and then returns up the west side of the Atlantic, a round trip of 25,000 miles, but tells as well of the green sea turtles, who every two or three years make the 1500 mile trip from the coast of South America to Ascension Island to lay their eggs. How these turtles orient themselves has yet to be demonstrated, and it is one of the virtues of this book that speculation concerning the whys and hows of migration receives as much emphasis as the description of various migration patterns.

Animals in Migration provides a good introduction to the general problem of migration. For those wishing to delve more deeply into special problems, there is an 18 page Bibliography at the end, up to date through 1968.

by Melvin A. Traylor, assistant curator of birds, Field Museum

CROSSWORD



Crossword by Lenore Perlove

Across

1. British Social Anthropologist, dec. (init.)
3. To clip suddenly
7. A lengthy native parley
9. Type of funereal cloth
10. Object of worship
11. Type of monkey
13. "A" and "B" are types of this ancient writing.
16. A small snake
18. A bushy clump
19. Belief system
24. Ampere (abbrev.)
25. District of Colombia (abbrev.)
26. Native of Dahomey
28. Leaping amphibian
30. Hawaiian Island
33. Hospital feeding (abbrev.)
34. A doctrine or theory
35. Sixth tone of diatonic scale
36. Small singing bird
37. Organization for alcoholics
38. Suitable
39. An Indian of Peruvian highlands
40. Note well. (abbrev.)
41. Suffix forming ordinal numbers
42. To convert into leather
43. Denoting relation to life (comb. form)
44. But
46. New (comb. form)
47. An image or representation
50. Picnic accessories
52. Small boats
54. Ego and libido are close relatives
55. Looks over quickly
56. Like (prep)
58. Husband-wife anthropological team
63. Seaweed
65. To guide or escort
66. Girl's name
69. Sign of the Zodiac
70. An indehiscent legume (Bot.)
73. Trench around fortification
74. Introducer of infinitive (prep)
75. Social group of families, clans, and generations
76. Swellings (Anat. & Zool.)
77. Midday
79. Quaker word for "you"
80. Pieces of broken earthenware

Down

1. Scientific dating method
2. Light-colored
3. Plan or outline
4. Born (Fr.)
5. Government taxing agency (abbrev.)
6. A little bit (Fr.)
7. Archaeological hoax
8. Fermented liquor
12. South Pacific islander
14. Atom bomb effect
15. Edges
17. A mineral spring
20. An Indian tribe
21. Form of greeting, (reversed)
22. Kinship grouping
23. Branch of linguistics (study of meanings)
24. King of Huns (Scandinavian legend)
27. A dry fruit or seed
29. Nucleic acid found in genes (abbrev.)
31. Pronoun
32. World organization (abbrev.)
43. Vessel used by chemists
45. Wife of Charlie Chaplin
48. Seal of a letter
49. Prefix denoting a negative
51. Yes (Span.)
53. Inhabitant of Arctic Coasts
56. Seaweed
57. Stains
58. Shining or clear
59. Central American Republic (abbrev.)
60. Exclamation
61. A carbonyl compound (Chem.)
62. Loose sediment
64. Wears away
67. Neither
68. Acid isolated from proteins (Chem.)
71. Ebenezer (abbrev.)
72. A promontory or cape
74. Digit of the foot
76. Neither
78. Exclamation of surprise

Answer to last month's crossword

M	U	S	E	U	M	F	I	E	L	D	T	R	I	P
I	■	I	O	N	■	A	N	N	■	A	M	I	■	A
N	E	T	■	E	A	R	L	I	E	R	■	P	A	L
E	R	■	S	A	■	M	A	N	■	K	A	■	N	E
R	A	M	O	S	E	■	N	■	F	E	A	R	T	O
A	■	E	■	Y	A	R	D	M	A	N	■	E	■	N
L	O	R	D	■	R	O	W	E	L	■	O	B	I	T
R	A	M	S	O	F	M	A	R	C	O	P	O	L	O
E	R	I	C	■	L	E	T	G	O	■	P	U	L	L
S	■	S	■	B	A	S	E	E	N	D	■	N	■	O
O	N	S	W	A	P	■	R	■	S	E	A	D	O	G
U	E	■	E	O	■	T	W	O	■	N	O	■	D	I
R	O	T	■	B	R	E	A	S	T	S	■	A	D	S
C	■	C	T	A	■	S	Y	L	■	E	R	R	■	T
E	X	H	I	B	I	T	S	O	F	R	O	C	K	S

FIELD BRIEFS

Dr. Austin L. Rand Retires

"I've been fortunate in being able to earn a living at something I'm very interested in," says Dr. Austin L. Rand, Field Museum's chief curator of zoology. Dr. Rand, who will retire on October 31, has been interested in animals and, particularly in birds, as long as he can remember.

Standing six feet six inches tall and weighing 250 pounds, Dr. Rand has been described as looking more like a retired lineman for the Green Bay Packers than a soon-to-retire museum curator.

A native of Nova Scotia, Dr. Rand received his bachelors degree from Acadia University in Canada and then took two years out to go on an international expedition to Madagascar before getting his doctorate at Cornell University.

Dr. Rand joined Field Museum staff as Curator of Birds in 1947. He has served as Chief Curator of Zoology since 1955. Prior to 1947, he was on the staffs of the American Museum of Natural History in New York and the National Museum of Canada at Ottawa.

Expeditions to study and collect birds and mammals have taken Dr. Rand to such diverse places as New Guinea, Northwest Canada, Central America and the Philippine Islands.

Dr. Rand is responsible for tens of thousands of bird specimens which have been added to the Museum's collection. One of the most important collections which he acquired for the Museum was the van Someren Collection which numbers some 17,000 specimens, mostly from eastern Africa. This collection, from which original descriptions of at least 37 kinds of birds have been based, was brought together by Dr. V. G. L. van Someren during a period of more than 40 years. Dr. Rand remembers the excitement in the Museum the day the collection arrived from Nairobi. "Nine huge cases arrived in bond at the Museum," said Dr. Rand. "There was not enough room in the bird range to open them so we put them in the fourth floor paint shop. There, under the watchful eyes of two United States customs officers, the paint shop hummed with activity as everyone vied for a crowbar, nail-puller, hammer, screwdriver or tin shears to get a look at the Guinea fowls, hawks, hornbills, mousebirds, honey-guides and many other species which lay side by side, row upon row, layer upon layer, in perfect condition."

Running parallel with his interest in researching and exhibiting birds has been Dr. Rand's passion for writing about birds on all levels, for all persons—young and old, scientist and layman. He has authored over 350 books and articles on birds, mammals and even some on travel. A few of the books for which he is well-known are: *The Handbook of New Guinea Birds* (co-authored with E. Thomas Gilliard), *Ornithology: an introduction, Stray Feathers From a Bird Man's Desk, A Midwestern Almanac, Pageant of the Seasons* (co-authored with his wife, Rheua M. Rand), *New Guinea Expedition* (co-authored with Richard Archbold) and *The Birds in Summer* (which has been translated into French and Italian).

Dr. Austin L. Rand

Dr. Rand has recently completed the manuscript for a lavishly color-illustrated book on the birds of North America to be published by Doubleday in 1971.

Air Pollution Workshop

A one-day workshop to discuss the problems of air pollution and alternative methods of financing a Cook County flood control program will be held in James Simpson Theatre Thursday, October 15.

Sponsored by the League of Women Voters of Cook County, the seminar is open free to the public. Non-members of the Museum will be admitted to the theatre only at the West entrance without charge.

Winter Tour

Dr. Carlos R. Margain, a prominent Mexican archaeologist with Mexico's Museo Nacional de Antropologia, will be the specialist accompanying the first section (December 31-January 29) of Field Museum's winter tour, "The Inca's Empire and Darwin's Galapagos." Dr. Margain's writings and research in both Andean and Mexican archaeology and anthropology are widely recognized. He is the author of "Las Colecciones del Museo del Oro" and "La Arqueologia de Esmeraldas".

Dr. Donald E. Thompson, Associate Professor of Anthropology at the University of Wisconsin, will serve as a specialist on the archaeology of the Incan area on the second section of the tour, which departs February 4 and returns March 5. Dr. Thompson is presently doing field work in Peru.

Francisco Leon Rodriquez of the Zoology Department of Universidad Catolica del Ecuador will be the specialist on birds, plants and wild life with both tour sections. Leon has been associated with the Charles Darwin Research Station on the Galapagos. For the past five years he has been doing research with the Universidad.

Phil Clark, chief of Museum tours, will lead both sections.

CALENDAR

HOURS
9 a.m. to 5 p.m., except Friday
Friday hours, 9 a.m. to 9 p.m.

The Museum Library is open
9 a.m. to 4:30 p.m.
Monday through Friday

Through October 25

Illinois By the Sea: A Coal Age Environment, a geological exhibit. Events that occurred 300 million years ago at two local sites are graphically explored. Hall 9.

Through October 26

Aurantia argiope, a large, garden-variety spider, on exhibit in the South Lounge. Because of its conspicuous color, many inquiries are received about this harmless insect at this time of year.

Continuing

75th Anniversary Exhibit: A Sense of Wonder, A Sense of History, A Sense of Discovery. Exciting display techniques examine man and his world, the history of Field Museum and some of its current research projects. Hall 3.

John James Audubon's elephant folio, *The Birds of America,* on display in the North Lounge. A different plate of this rare, first-edition copy, published by the author in 1827-38, is shown daily.

Fall Journey for Children, "Eye" Spy, a free, self-guided tour designed to test their powers of observation. The program offers boys and girls who can read and write an incentive to learn. Journey sheets are available at Museum entrances.

October 11

Free film presented by the Illinois Audubon Society, 2:30 p.m., James Simpson Theatre.

Fall Film-Lecture Series
Saturdays at 2:30 p.m.
James Simpson Theatre

October 10

"Scotland Afore Ye"
by Jonathan Hagar

A many-dimensioned view of this rugged and beautiful land includes the Lowlands and Highlands, the Hebrides and a search for the Loch Ness Monster.

October 17

"Russia"
by Dick Reddy

Aspects of city and country life, sightseeing in Moscow and Leningrad, and glimpses of the Russian people on vacation.

October 24

"Green Guianas"
by Arthur Erickson

A look at three small countries in South America between the Amazon and Orinoco rivers, Guyana, Surinam and French Guiana.

October 31

"Across Wilderness Canada"
by Dr. John D. Bulger

Attention is focused on nature and the outdoors, from Newfoundland westward to British Columbia and the Yukon Territory.

November 7

"High Himalaya"
by Russ Potter

A visit to West Pakistan, Gilgit, Hunza and Nagar, located in a spectacular mountainous setting, for an off-the-beaten-path film adventure.

Field Museum's Natural History Tours
Gardens
Wild Flowers
Birds
Archaeology
Congenial Travel Companions
Interpretations by Experts
The Unhurried Approach
Travel With All Dimensions

GUATEMALA
LAND OF COLOR & CONTRAST
Oct. 24–Nov. 6
$1,280 includes $400 donation

Gardens at Guatemala City, Antigua, Volcan Fuego, Quezaltenango. Ruins of Tikal, Iximche, Kaminaljuyu. Chichicastenango on All Saints Day. Lake Atitlan.

THE INCA'S EMPIRE
& DARWIN'S GALAPAGOS
Two sections: Dec. 31–Jan. 29, 1971, & Feb. 4–March 5.
$2,807 includes $600 donation.

(22 days of Andes, $2,457; 11 days of Galapagos cruise & Quito, $1,190—separately) Gardens in Bogota, Lima, La Paz, Quito. Ruins of Machu Picchu, Chan Chan, Pachacamac, Cajamarquilla, Ollantaytambo, Cuzco, Lake Titicaca, Tiahuanaco. Spanish Colonial art & architecture in Colombia, Peru, Bolivia and Ecuador.

LEADER ON ALL TOURS, PHIL CLARK, former Editor of Horticulture magazine; former Garden Editor of The News, Mexico; author, "A Guide to Mexican Flora"; Field Museum Natural History Tours Chief; accompanied by Archaeologists specialized in the areas.

All donations to Field Museum are tax deductible.

Rates are from Chicago; may be adjusted from other points.

Write: Field Museum
Natural History Tours
Roosevelt Rd. at Lake Shore Dr.
Chicago, Ill. 60605

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Field Museum of Natural History

BULLETIN

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Field Museum of Natural History
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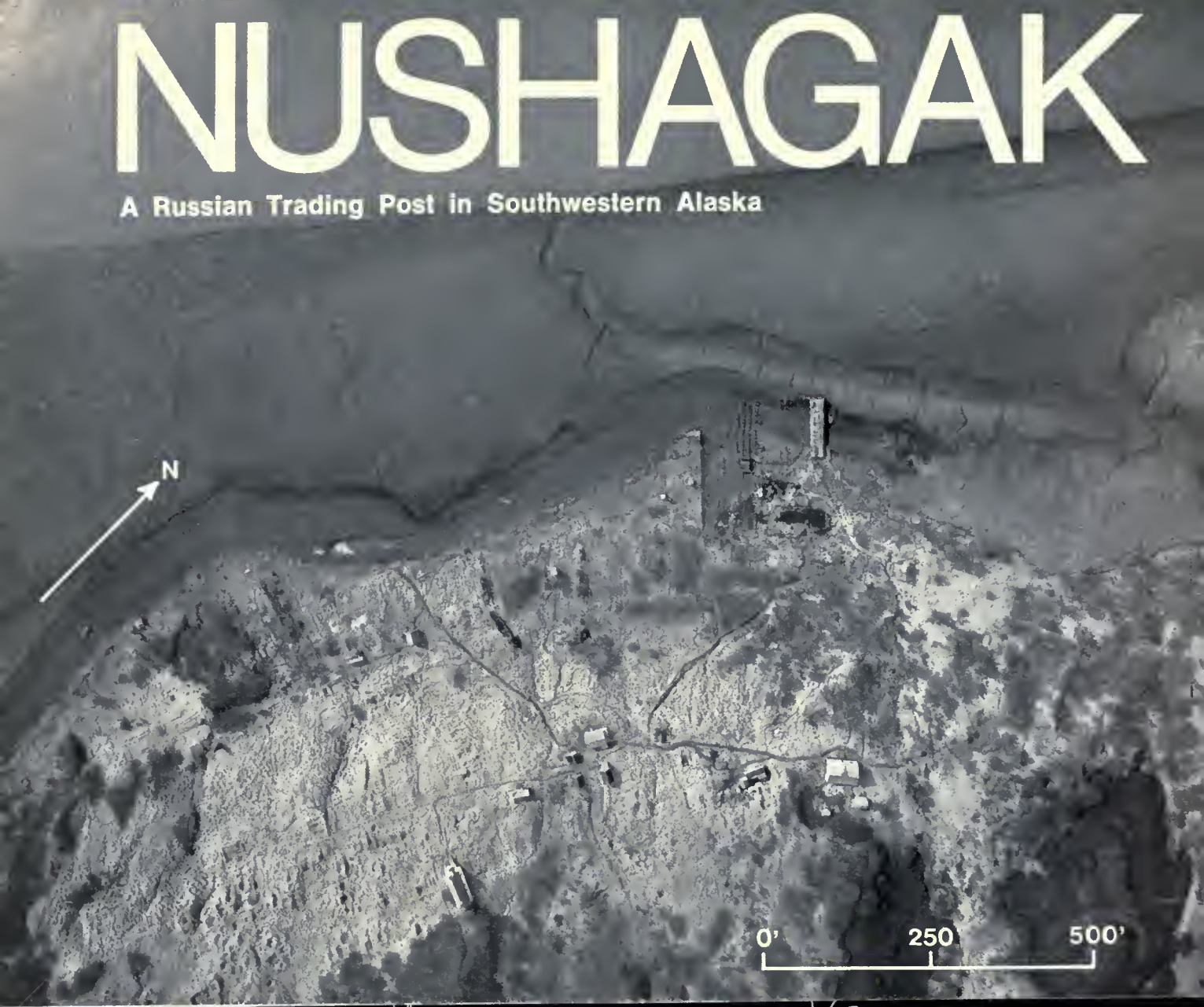
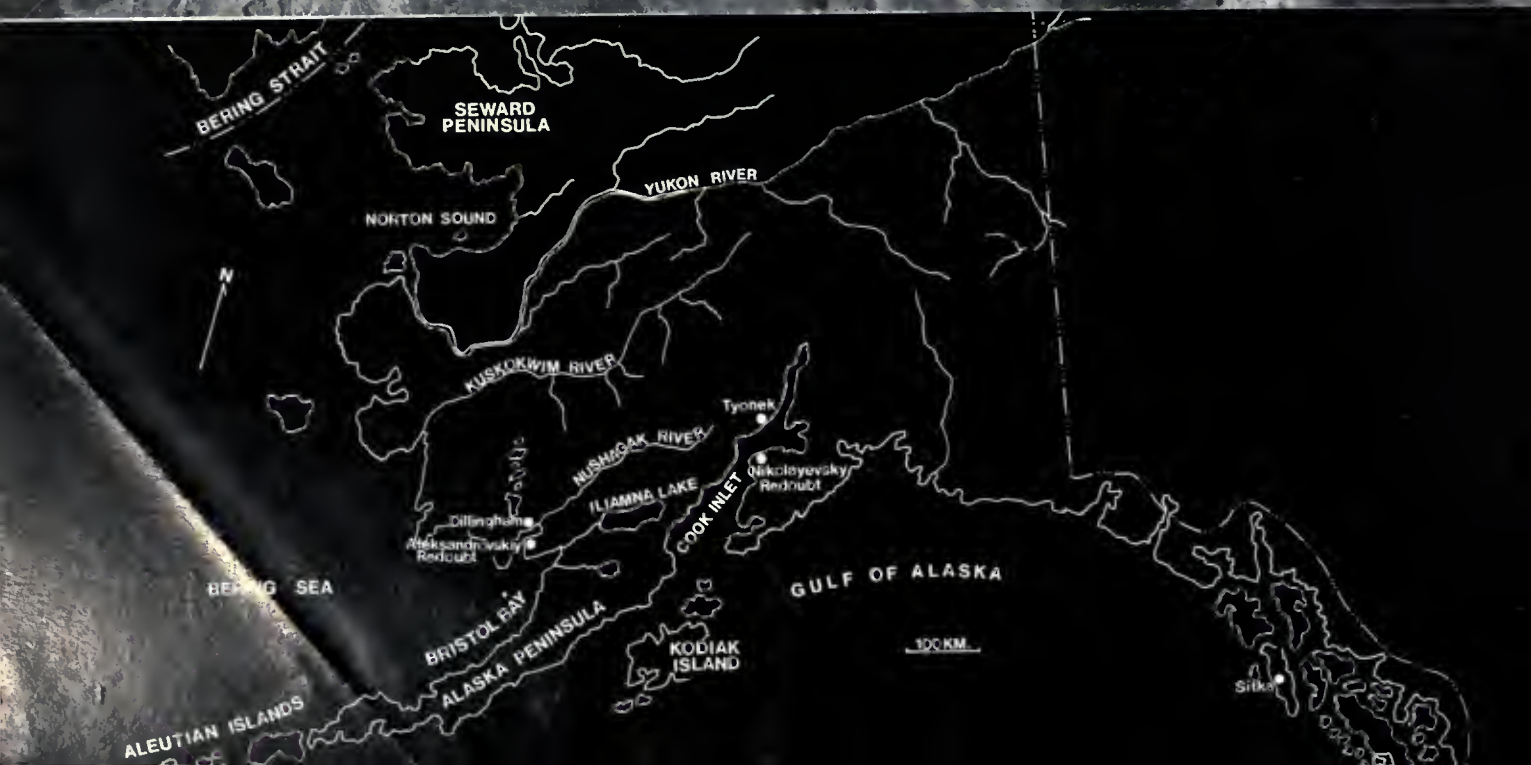
NUSHAGAK

A Russian Trading Post in Southwestern Alaska





by James W. VanStone

According to an historical anecdote, Tsar Peter the Great of Russia, during his journey abroad in 1697-98, was chagrined to learn that while other European monarchs were only too clearly aware of the boundaries of their realms, he did not know the extent of his immense homeland. Determined to ascertain the eastern limits of the lands under his rule, Peter commissioned, in 1725, the first of two momentous expeditions to the unknown wastes of the North Pacific Ocean. Both were under the command of the Danish navigator Vitus Bering, one of the many foreign mariners drawn into the newly created Russian Navy. After years of arduous and dangerous travels, Bering succeeded not only in traversing the eastern reaches of the Russian Empire, but he also, in 1741-42, crossed the sea which today bears his name.

Following Bering's explorations and discoveries, Russian fur traders began to exploit those areas of Alaska where fabulous riches in furs—seals, sea otters, foxes—had been reported. Rivalry among these early entrepreneurs was intense, but in 1799 the Russian-American Company secured a monopoly of the Alaskan trade and the capital of the new Russian possession was established at Sitka.

Early in the nineteenth century, as fur-bearing animals began to decline in the Aleutians and other traditionally exploited areas, the Company turned to southwestern Alaska where it hoped to reap new profits through trade with the Eskimos for beaver pelts. A number of fortified trading posts, or "redoubts," were established north of the Alaska Peninsula, the first of which was named Aleksandrovskiy Redoubt in honor of Tsar Alexander I. Located on a high bluff at the mouth of the Nushagak River opposite the present-day town of Dillingham, it afforded a commanding view of the entire bay and no one approaching the mouth of the river could do so unobserved by personnel at the post (see map). Using the new redoubt, later to be called Nushagak by Anglo-Americans, as a base of operations, Company employees explored the Nushagak and Kuskokwim rivers and opened the interior regions of southwestern Alaska to the fur trade.

Air photo of Nushagak (opposite page) taken in 1963. (U. S. Dept. of Interior, Bureau of Land Management)

Dr. James W. VanStone is Curator, North American Archaeology and Ethnology in Field Museum's Department of Anthropology.

Today the grassy slopes of Nushagak are virtually deserted. An air photograph (page 2) taken in 1963 shows only an abandoned Russian Orthodox church, a few dilapidated houses, and twenty to thirty rectangular depressions in the earth indicating former Eskimo dwellings. This is all that remains of what was once a busy trading and missionary center with a population of 150-175 Russians, Eskimos, and people of mixed ancestry.

The redoubt got off to a promising start in 1818 under the direction of Fedor Kolmakov, an energetic and personable trader who quickly established trade relations with the neighboring Eskimos and generally helped to spread the Company's influence in the region. Kolmakov successfully guided the affairs of the post until his death in 1840. He was buried in the Nushagak cemetery on top of a small hill above the settlement, and a twenty foot cylindrical wooden shaft with a globe on top was erected to his memory.

During Kolmakov's sojourn a small chapel, mill, new barracks and a *kashgee* or Eskimo ceremonial house, probably built to entertain visitors trading at the post, were added to the original buildings which consisted simply of a small fort and barracks house. About 1857 a priest's house was built, and in 1860 the Company, at the request of church authorities, ordered the construction of a new church to replace the small chapel built earlier. This structure, the last of importance to be constructed at Aleksandrovskiy Redoubt during the Russian period, was conceived on a comparatively grand scale with such materials as nails, roof tiles, doors and windows to be sent from Sitka.

Business at the redoubt generally was good. Eskimos from interior and coastal settlements brought pelts to exchange for such items as tobacco, tea, hard biscuits, glass beads, cast iron kettles, needles, combs, pipes, mirrors, axes, canvas tent cloth, flannel blankets, cloth dresses, buttons and small bells. Indeed, the earliest recorded population figures for Aleksandrovskiy in 1849 indicate that 168 persons lived at the post. Thus the village was probably the largest on Nushagak Bay, even during the period after 1846 when, for reasons of economy and administrative convenience, a decision was made to reduce Aleksandrovskiy from a redoubt to an *odinochka* or trail house subordinate to Nikolayevsky Redoubt on Cook Inlet.

In 1867 Alaska was sold to the United States, and in June 1868, Captain J. W. White, in command of the United States Revenue Steamer *Wayanda* visited "Nushagak," as it is usually known in sources of the American period. White mentions the decaying buildings and notes that the assets of the Russian-American Company had been transferred to Hutchinson, Kohl and Company of San Francisco. This firm, which ran the Nushagak station for at least a year and possibly two, was soon reorganized to form the Alaska Commercial Company which dominated trade in southwestern Alaska throughout the rest of the nineteenth century and well into the twentieth.

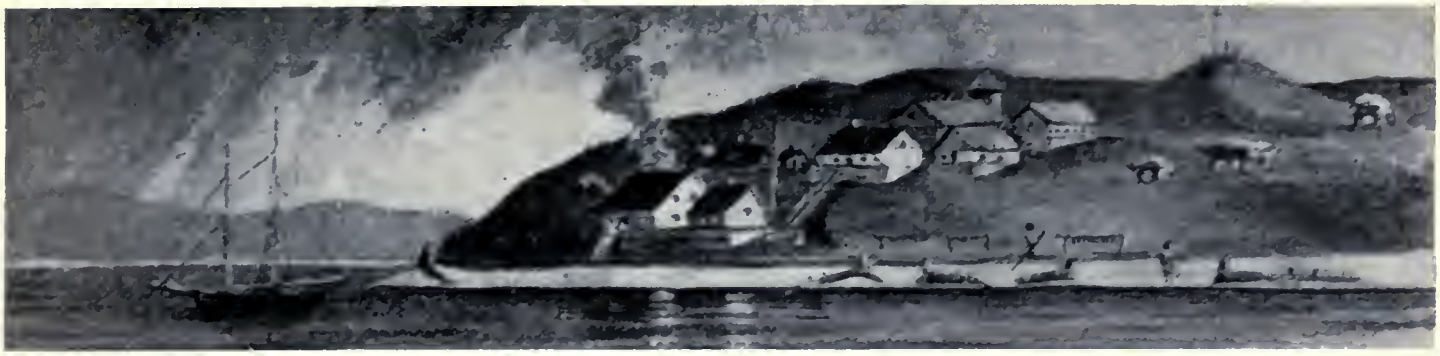
Sometime between 1872 and 1874, during three seasons of work in Alaska, the historian and naturalist Henry W. Elliott visited Nushagak. He has left a colorful description of the settlement.

> The village itself is located on the abrupt slopes of a steep, grassy hillside which rises from the river's edge. The trading-stores and the residences of the priest, the church, log-huts of the natives and their baraboras are planted on a succession of three earthen terraces, one rising immediately behind the other. All communication from flat to flat is by slippery staircases, which are fraught with danger to a thoughtless pedestrian, especially when fogs moisten the steps and darkness obscures his vision.
>
> The red-roofed, yellow painted walls of the old Russian buildings, the smarter, sprucer dwellings of our traders, with lazy, curling wreaths of bluish smoke, are brought into very picturesque relief by the verdant slopes of Nooshagak's hillside, caught up and reflected deeply by the swiftly moving current of the river below. The natives have festooned their long drying-frames with the crimson-tinted flesh of salmon; bleached drift-logs are scattered in profusion upon a bare sandy high-water bench that stretches like a buff-tinted ribbon just beneath them.

Nushagak around 1900. (National Archives photo)

A view from the bluff looking northeast. (National Archives photo)

Some Eskimo houses at Nushagak, around the turn of the century. (National Archives photo)



and above, the dark, turbid whirl of flood and eddy so characteristic of a booming, rising river.

Elliott also drew a sketch of the village (page 5), in the proportions of which are such that it is difficult to relate the location of the structures shown to the site as it appears at the present time. In this drawing six buildings can be easily distinguished and there would appear to be two or three more. Those closest to the beach are almost certainly associated with the Alaska Commercial Company, while those on the bluff would appear to be church-related buildings. Most of the semi-subterranean earth-covered Eskimo residences were southwest of the church in the area where the drawing shows three elevated storage caches. The monument erected to the memory of Fedor Kolmakov, long since fallen, can be seen in the upper right hand corner of Elliott's drawing.

At the very end of the nineteenth century the flourishing settlement was influenced by the salmon fishing industry, one of the most significant commercial innovations in Alaska's history. Although the Alaska Commercial Company had exported barrels of salted salmon as early as 1880, it was the invention of the canning process that provided the means by which the Alaska salmon runs could be profitably harvested. In 1883 the first cannery on Bristol Bay was constructed about two miles north of Nushagak and in 1899 the Pacific Steam Whaling Company and Alaska Fisherman's Packing Company erected canneries directly in front of the settlement. The companies imported Chinese workers to can the fish and the fishermen represented many nationalities and ethnic groups. With its exotic personnel and new and strange material culture, the fishing industry acted as an effective agent of change into the orbit of which even the most retiring Eskimo at Nushagak, visitor or resident, must have been drawn. When the canneries closed down at the end of each summer after the brief, exciting salmon runs, the villagers were left with a store of new ideas about the outside world and probably a few material items not obtainable at the store, but available through trade with a friendly fisherman from San Francisco or homesick cannery worker from Hong Kong. The attraction of the canneries is doubtless reflected in the population figures which by 1900 had soared to 324.

During the summers of 1900 and 1901 the United States Fish Commission Steamer *Albatross* visited Nushagak and a member of the crew took a number of photographs. One of these pictures (top, page 4), taken in front of the village, shows four structures on the beach up against the bluff. The large frame building in the center is the Alaska Commercial Company, while one of the log houses, probably the one immediately to the left of the store, was the trader's residence. The other two log structures may have been storehouses. According to older residents of Dillingham, the fenced-in area in front of these buildings at one time enclosed gardens maintained by John W. Clark, agent for the Alaska Commercial Company at Nushagak from the middle 1880's until his death in 1897. It is probable that the original Russian buildings stood in the same location as those just described, and it is possible that one or more of the log structures shown in this photograph was actually built during the Russian period.

Several wooden buildings on the edge of the bluff show up better in another *Albatross* photograph (center, p. 4) taken from that area and looking to the northeast. Eskimo houses and caches are shown along with three frame houses, a church, and an uncompleted frame structure. The largest house with a four-sided roof situated on the edge of the bluff just above the store may have been the priest's residence. The church building is almost certainly the one built in 1860 and shown in Elliott's drawing of the settlement. This building must have been torn down shortly after these photographs were taken, as a new church, located to the southwest of the old one and visible in the air photograph, was constructed in 1904. It was in use until about 1963.

A third *Albatross* photograph (bottom, p. 4) shows typical Eskimo houses at Nushagak. These semi-subterranean earth and log structures were in use in the area until the 1920's. Certain modifications in traditional construction, notably glass windows, frame doors and stove pipes, can be seen in this picture.

Nushagak had reached its peak at about the time these photographs were taken. In 1918-19 a serious influenza epidemic swept much of Alaska and took a severe toll at the settlement. So many people died that bodies were placed in a number of houses and these structures caved in. The two salmon canneries were abandoned during the 1930's as declining salmon runs forced the industry to consolidate its operations. Of much greater significance, however, were the attractions of Dillingham which drew population away from Nushagak and emerged as a cosmopolitan commercial center for the area in the 1920's and 1930's.

After 1930 the village is no longer listed in census reports. In 1964 there were two families with houses at Nushagak and even they did not spend the entire year there. In 1969 only one family remained.

a child goes forth

The time between infancy and adulthood is a time of becoming, of reaching out, of expanding awareness. It is perhaps the most important and fragile time of all.

There was a child went forth every day,
And the first object he took'd upon that object he became
And that object became part of him for the day or a certain part of the day
Or for many years or stretching cycles of years.

"There Was A Child Went Forth"
Walt Whitman

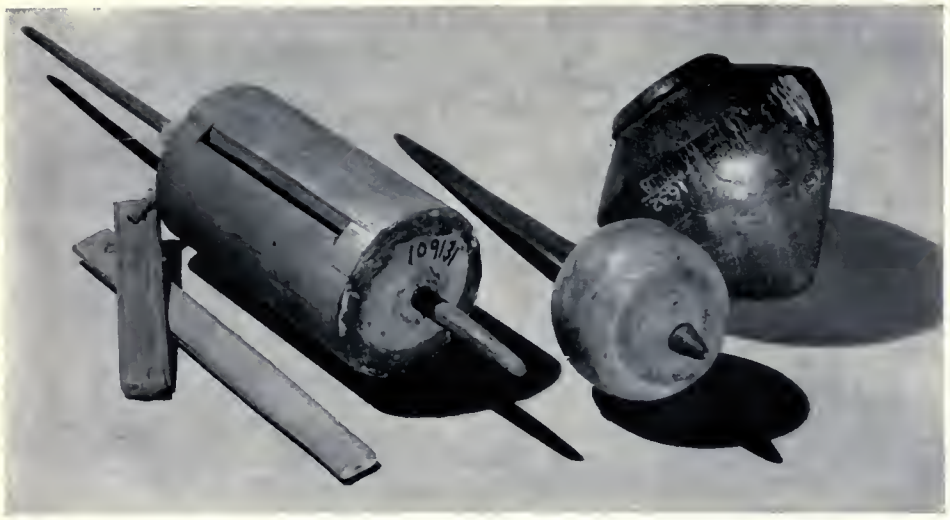
Playthings, usually miniature copies of familiar things, animals, people, play a very important role in a child's world. These playthings are made by adults and represent adult ideas, tastes and values. Whether consciously or unconsciously, the objects a parent gives a child are indicative of the way the adult perceives of the world, and are instrumental in developing the child's social awareness.

In Field Museum's exhibit, "A Child Goes Forth," opening November 18, these instruments of enculturation—toys—are explored as indicators of the cultures which produced them.

The first part of the exhibit, arranged in cultural groups, is designed to build an awareness of how toys can give information about a people, their way of life and their values. For example, the way a toy is fashioned often indicates the technological advancement of a society, while the material it is made of can reflect the environment. Toys which take the form of familiar animals can represent a vital concern with the natural environment; action toys or games may reveal cooperative or competitive attitudes of a society. For instance, American Indian cultures contain a predominance of physical, active games and toys—various ball and dart games are most popular. On the other hand, in the Japanese culture, one can see a deep concern for social structure. Japanese dolls reflect this concern; they are used for teaching etiquette, protocol and other social amenities.

Before leaving this section of the exhibit, the visitor will have the

This pull-toy from Java depicts a carabao with a human figure.



Tops are an important example of toys that are seemingly universal. These tops are from the Philippines, Easter Island and Malaya.

opportunity to contemplate the values, technology and social concerns of America as reflected in a large collection of contemporary American toys.

But what exactly is a toy? Are stones, sticks, small boxes, keys—things children play with—toys? The exhibit explores the fascinating fact that children often abstract objects from their environment and infuse them with new meaning; a common object may become a precious plaything.

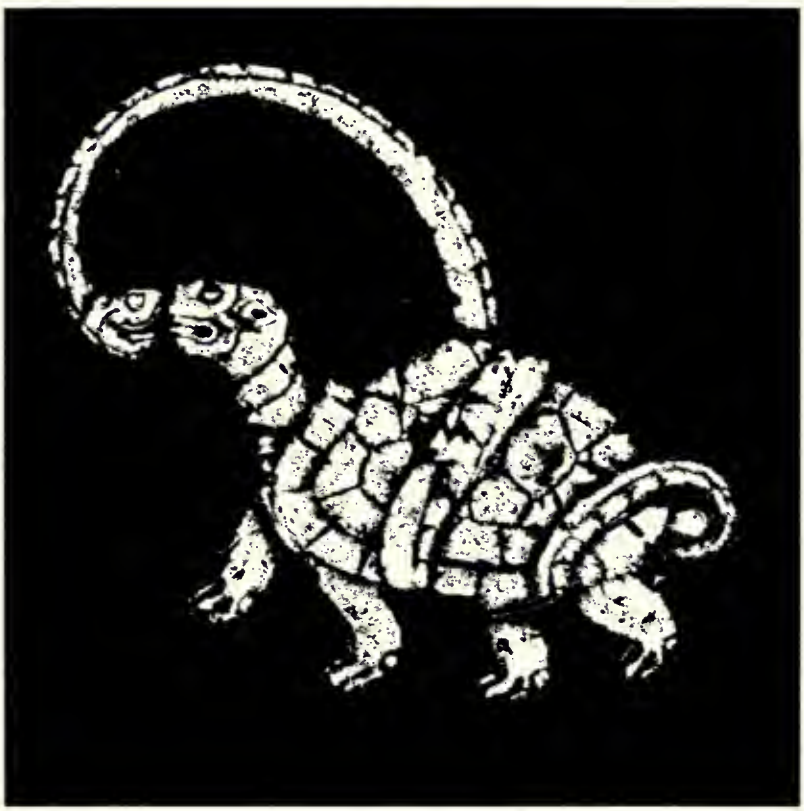
Equally fascinating is the development of seemingly universal toys. Balls, dolls, tops, animal toys, ball and cup games are among the playthings that have transcended time and crossed cultural borders. A comparative study of the designs and materials of these toys reveals some interesting differences among cultures.

Ultimately, "A Child Goes Forth" demonstrates the very important nature and function of playthings in the past, and silently asks the question whether some of our contemporary American toys properly prepare our children for a meaningful adulthood.

These contemporary American toys reflect a wide range of children's interests, and perhaps mirror our society concerns.

Turtle Lore: Fact and Fiction

by Karen Ramey



Two hundred million years before the first sit-in or love-in, before the advent of Yoga or other such philosophies, the great granddaddy of passive resistance and meditation was born, or rather, hatched. This exemplary old fellow was well-established on planet Earth when the first dinosaur pipped his eggshell and began to see how big he could grow. While the living creatures of the earth battled for space and food, peace was the very keynote of turtle evolution. Whereas the turtle's relatives, both extant and extinct, the lizard, snake, alligator, and crocodile, as well as the dinosaur, bring horror to the eyes of many, the gentle turtle usually evokes only friendly feelings. His secret to success lies in his cumbersome, if not comical, shell, a truly spectacular adaptation.

The first ancestors of the turtle are generally presumed to be the cotylosaurs, a group of early reptiles with bony plates set in their skin. Over a period of perhaps forty million years, these bony plates, or dermal bone, enlarged. At the same time, the ribs widened and fused with the backbone and the dermal plates. Thus a carapace, or upper shell, was produced. The lower shell or plastron was simultaneously created through the enlargement and fusion of the primitive reptilian abdominal ribs, and parts of the shoulder girdle.

As the bony-box building project continued, more and more problems were exposed. For one, the legs couldn't be left to dangle outside unprotected. Somehow the pelvic and shoulder girdles had to be drawn inside the modified ribs so that when retracted, the legs could be secure in the shell rather than merely squashed against the outside. No easy job, but the inventive turtle nevertheless succeeded. But now another vital problem had to be encountered, since immobile ribs make for very poor breathing. The method of inflating and deflating the lungs with the diaphragm as practiced by other vertebrates just wouldn't work. So the turtle established a new method of breathing which utilizes two separate groups of muscles in the abdominal area and the viscera.

One must realize, of course, that none of these fancy adaptations happened overnight. Epoch after epoch of turtle evolution produced large numbers of bizarre turtle-types. A fine example is *Archelon,* which lived during the Carboniferous Period, and was perhaps the largest turtle ever to exist. He was 11 feet long and 12 feet across at the flippers. Another ancient turtle, *Meiolania,* was equipped with a horned skull two feet wide. The approximately 250 species of turtles living today are survivors of a much more numerous group in the past.

The survivors, however, should not be considered commonplace. Extremes and oddities are the rule rather than the exception in turtle lore. For instance, the familiar tale of the tortoise and the hare is built around the "common knowledge" that the turtle is a slow-poke. But sea turtles are capable of attaining the greatest speeds of any modern reptiles. The leatherback turtle, *Dermochelys,* can swim as fast as the best human runner can pound out the hundred yard dash. This massive reptile, by the way, reaches a length of nine feet and a weight of 1500 pounds.

Land turtles do not compare with this marine giant in size, let alone in speed, but they are sometimes enormous in their own right. The famous Galapagos tortoise (*Testudo*) and its counterpart on islands of the Indian Ocean (also *Testudo*) can reach a length of four feet and a weight of 500 to 800 pounds. In North America, the largest turtle is the alligator snapper (*Macroclemys temmincki*), which weighs as much as two hundred pounds. The alligator snapper's size is not quite so startling as his craggy carapace and peculiar tongue. His tongue sports a curious appendage shaped like a worm. The alligator snapper is capable of wriggling his little "worm" convincingly enough to lure hungry fish right where he wants them!

Among other curiosities, questions about a turtle's age are frequent. Although stories about the age of a turtle are often greatly exaggerated, turtles are nevertheless the longest-lived vertebrates in existence. They are the only group to exceed man in this capacity. The very fact that they often live longer than man makes longevity records difficult to maintain. The longest turtle life for which there is an authentic record is that of "Marion's Tortoise," a *Testudo gigantea* of the Indian Ocean. In 1766, this particular turtle was taken by the French explorer, Marion de Fresne, from its native island to the island of Mauritius where there are no native tortoises. The British captured Mauritius in 1810 and Marion's Tortoise was handed over to British troops by the surrendering French forces. It then lived in the artillery barracks at Port Louis until 1918 when it fell through a gun emplacement to its death. The authentic record of this turtle is a full 152 years. Add to that approximately thirty years, since it was an adult when captured, and it could not have been younger than 180 years.

Among the more commonplace creatures, the little box turtle, *Terrapene,* also has its age records. There is good evidence that a box turtle has a life expectancy of forty to fifty years. Quite reliable records also indicate that some box turtles have spanned as many as 123 years.

In Hindu mythology, the tortoise is extremely important. In one myth, the universe is conceived of resting on four elephants, which in turn stood on the back of a tortoise with a serpent enveloping it.

The Chinese clay tile (shown on p. 1) represents the Four Quarters of the Universe. The black tortoise entwined by the serpent, known as the "Sombre Warrior" occupies the lower place on this map of the heavens, and is the symbol of winter.

One theory why the tortoise and serpent are often associated is that this pair of reptiles, appearing in a deadly embrace, represent the tactics of warfare. Neither of the opponents is able to attack the other; the serpent is unable to crush the shell of the tortoise, while the tortoise, because of its short neck, cannot reach the serpent.

Turtles have sparked the imaginations of men the world over regardless of time or culture. Turtles have been found in cave paintings dating from pre-history. Perhaps turtles appealed to the early artists and craftsmen because of their very odd appearance or because of the designs on many carapaces, evoking kaleidoscope-like fascination. The turtle has played an important role in the folklore of groups as widely divergent as the Hindus, Burmese Buddhists, Chinese, Greeks, and American Indians.

The Onondaga Indians of America, for example, believed the Chief of Heaven created the world when he became jealous of his wife. He uprooted the Tree of Life in Heaven and thrust his wife down through the hole in the sky. As the Sky Woman fell, the waterfowl soared up to catch her. The Loon instructed the water animals to bring soil from the sea so Sky Woman could

The Iroquois Indians make rattles out of snapping turtles. The head and neck of the turtle is stretched over a stick inserted to form the handle. They are used in the Great Feather Dance and the Dance of the False Faces.

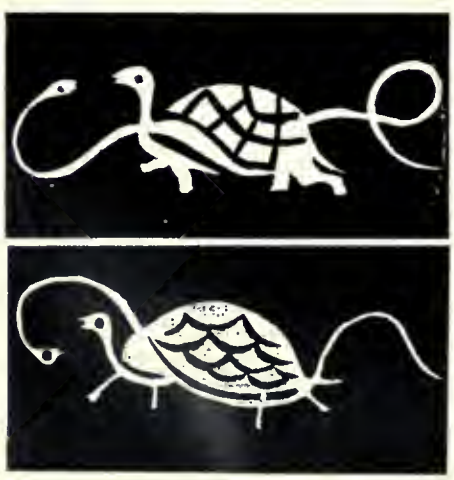
land. The Muskrat put the soil on the back of a snapping turtle so that it made a little island above the water. Sky Woman was then gently taken to the ground by the birds. She became the Great Earth Mother in Indian legends.

In Chinese legend, the tortoise played a different, though equally important role in creation. The tortoise, Kwei, Lord of the Northern Quadrangle, was the longest-lived, wisest and most experienced creature. Therefore, he became the advisor to the creator of the world and accompanied the creator in his great work. It is said that the first characters were traced from segments of Kwei's carapace, thus giving rise to the art of writing. The carapace of Kwei's descendant was also invaluable in that it carried instructions in the form of maps for drain ditches, irrigation and navigation channels. These instructions were used by the first of five mythological emperors as he directed the development of the land.

Perhaps because of Kwei and his descendants the Chinese believe that the turtle carries on its carapace knowledge of the past and the future. Through this knowledge, they think that the turtle may be able to influence the future, or at least give advice. Kwei was attributed not only with knowledge, but also with good luck, for he controlled the first of the five most precious things in the life of human beings, the gift of longevity. Even today, stone carvings of turtles, erected by decree of Chinese emperors, stand in front of government offices, by waterways, channels and dikes to protect them.

Other Far Eastern civilizations also utilize the turtle in legend and ceremony. The Hindus as well as the American Indians use the turtle to symbolize the universe. Its dome-shaped back represents the vault of the sky; its belly represents the earth which moves upon the waters. The Buddhists elevate the turtle's status by maintaining tanks of live turtles in their temples. It is considered meritorious to feed them or to add to their numbers by purchasing them alive from the streets where they are sold as food.

In ancient Greece, the turtle was the badge of the island city-state Aegina, and was sacred to Aphrodite, whose temple stood near the harbor of Aegina. Long before Athenians took to the sea, the commercial enterprises of Aegina reached as far as Asia Minor and northern Greece. The Aeginetans issued



the earliest coinage of European Greece, stamped, of course, with the symbol of the turtle. These "turtles" served as the currency of the entire Peloponnesus until the defeat of Aegina by Athens. Interestingly enough, the earliest coins from Aegina show the sea turtle, whereas the later coins are stamped with the image of the land tortoise, but no explanation for the change is known.

There is no question that the turtle has played a substantial role in the history of man. In his docile, mild-mannered way, he has found his way into the minds and imaginations of story-tellers and artists in societies the world over.

New uses for turtles are developing with the space age. Howard Campbell of the University of Florida writes of the amazing adaptability of the turtle in stress situations. Turtles are capable of varying the distribution of blood in the body thereby increasing its efficiency in times of oxygen shortage. They are able to maintain metabolic activities for considerable periods of time without taking in fresh oxygen. Some can utilize the oxygen in water through processes known as pharyngeal and anal breathing, which serve to lengthen the time spent under water. Turtles have been known to endure conditions from anaerobic to one hundred percent 0_2, high to low pressures (as low as 1/10 earth's air pressure at sea level), ultraviolet radiation, and low temperatures. Campbell writes in *International Turtle & Tortoise* (Vol. 1, No. 2), "Such adaptability in stress situations, and their proven ability to recuperate from extended surgical operations, makes them prime subjects in studies of stress. Perhaps a turtle will be one of the first earthlings to make the trip to Mars and report back via telemetered information of its physiological state, some idea of the conditions it finds there."

Thus the turtle has plodded from the Age of Dinosaurs to the Space Age. He has stubbornly resisted violence and capitalized on unobtrusiveness. If any animal can endure the throes of man's conquest of the earth, the turtle should. Let's wish him luck.

Karen Ramey is Assistant, Division of Amphibians and Reptiles in the Department of Zoology at Field Museum.

Museums in a Changing World

by Lothar P. Witteborg

Alvin Toffler, in his recent book *Future Shock* states that Western society and especially the United States is suffering from a malady defined as "the dizzying disorientation brought on by the premature arrival of the future." What brings on this future shock is a rate of social change that has become so fast as to be impossible for most human beings to assimilate. The malaise, mass neurosis, irrationality and free-floating violence already apparent in contemporary life are merely a foretaste of what *may* lie ahead unless we come to understand and treat this disease. Toffler argues that "future shock arises from the superimposition of a new culture on an old one. It is culture shock in one's own society. But its impact is far worse. Most travelers have the comforting knowledge that the culture they left behind will be there to return to. The victim of future shock does not."

Today, Toffler contends, we are all renters, all nomads. "We have not merely extended the scope and scale of change, we have radically altered its pace," he says. "We have in our time released a totally new social force—a stream of change so accelerated that it influences our sense of time, revolutionizes the tempo of daily life, and affects the very way we 'feel' the world around us."

All this has happened because man can no longer absorb all that is relentlessly new, and traditional institutions seem unable to encompass and interpret headlong technological change and its social consequences. Also, accelerating change has made obsolete the methods by which we arrive at social goals. In trying to react to the current crises, our technocrats are reaching for the tried and true methods of the past with obviously little success.

Our educational system is also under attack. "It gets pretty depressing to watch what is going on in the world and realize that your education is not equipping you to do anything about it," writes a University of California senior. This student is not a radical, and has never taken part in any demonstration. She will graduate with honors, and profound disillusionment. From listening to her, and to a good many like-minded students at California, Midwest and East Coast campuses, one begins to understand what they mean when they say that a liberal arts education isn't relevant. They mean it is incoherent. It consists of bits and pieces which don't stick together, and have no common purpose or total vision of the world. Most liberal arts colleges and universities have no apparent overall defined philosophy or goals. So it is no small wonder that our youth has become so disenchanted with their world and have established a somewhat nihilistic attitude toward life.

How does the museum fit into all of this? What has the museum's position been with regard to its role in society —fifty years ago, thirty years ago, twenty years ago? Does the museum still serve the same function today? The answer in most instances is yes, but should it be? And that answer is no.

The museum has traditionally occupied a rather honored position in our society as it perpetuated the image of the "Temple of the Muses." This is well pointed out by a recently published report (August 1969) by the American Association of Museums which recognized the need to establish a new definition of a museum acceptable to the majority of U. S. institutions. This definition is as follows: ". . . a museum is defined as an organized and permanent non-profit institution, essentially educational or aesthetic in purpose, with professional staff, which owns or utilizes tangible objects, cares for them, and exhibits them to the public on some regular schedule." The committee believed this definition of a museum to be "accurate and suitable for general use throughout the United States."

While the new definition of what a museum is is basically correct, there is one grave omission, and that is the museum's social responsibility with regard to contemporary relevancy! Dr. A. E. Parr, former director of the American Museum of Natural History, stated it beautifully in an article

Lothar P. Witteborg is Chairman of the Department of Exhibition at Field Museum.

published in a museology journal from India, *Studies in Museology*. Parr's statement is as follows: "The natural history museums of today are at a crisis stage. Many have declined in community standing and in their status among cultural institutions. Their expositions, in the traditional vein, offer little relief from the pressures of world problems, and less help towards their solution." What Dr. Parr stated four years ago is even more important today, since not too much has been done in our museums to counteract the crisis that surrounds almost every aspect of our daily lives. To add to this dilemma of inactivity and traditional thinking is the surprising demand put on the museums by increased attendance and requests for service which have strained most museums' financial resources to the breaking point.

Where does this leave the casual visitors and the student at a time that calls for a sharp increase in the educational and cultural opportunities which museums are potentially equipped to provide? After all, we can tell the story of culture change, environmental pollution, population explosion, human aggression, etc. so that it is meaningful, and we can do it better than any other media, because we have the actual *things*, and we understand the complex processes that are involved. However, the answer is not in the fleeting trip of organized school groups, in one exhibit hall and out again at rapid march tempo. The answer is not in the endless rows of taxonomic and systematic exhibits, badly illuminated and with the barest of labels. The answer is not in the exposition of the three-dimensional textbook with endless label copy, so specialized that even a trained viewer has to pause and scratch his head. And most certainly—it is not the so-called education oriented exhibit where facts and information are force-fed in a continued maze of a controlled environmental walk-through exhibit layout. We must stress contemporary involvement and immediacy in our exhibition halls and educational programs as well as in all of our related activities. We must do this in order to survive.

Talking about surviving, many people have probably seen, or at least read about, the much publicized centennial exhibit "Can Man Survive?" at the American Museum of Natural History. This very expensive exhibit, containing approximately four thousand square feet of audio-visual equipment (sound, slide and film projector), as well as photo blow ups and some dramatic three-dimensional items took on the problem of the deteriorating environment. The American Museum is to be applauded for taking on a most important contemporary problem and making a public statement. However, one must look at the exhibit's statement in historic perspective. The exhibit was planned in 1968 and opened to the public in May of 1969. It was at a time when the "prophets of doom" were just making their first public appearances and all statements regarding the problem of population and the environment were totally negative. The exhibit echoed this approach with the added element that it was totally anti-human. It talked down to the visitor and scolded him; this plus the negativism left the viewer with absolutely no hope in the future, nor did it offer any possible solutions. This I find is not fulfilling our responsibility as public institutions and is totally unacceptable.

We must re-evaluate our museum objectives, otherwise our glorious institutions will themselves become victims of extinction like so many of our specimens now languishing in exhibit cases and storage vaults.

"A Sense of Discovery" is explored in the Museum's 75th Anniversary exhibit.

We must stop and do some careful thinking and move in new directions and hope that we are not too late. We must make the adjustment that is called for, namely, to create public awareness of contemporary problems in an enlightened manner. If we fail, it would be fatal. Our museums would then end up as mere libraries of things with lonely caretakers to dust the many shelves.

There are a number of things natural history museums can do to be more contemporary as well as relevant. The museum's exhibits should present the natural world, not from the viewpoint of any particular scientific discipline, but rather as it might be seen in its totality. The specialization of knowledge characteristic of modern science presents a fragmented picture and may be responsible for a narrow, departmentalized view of man and his world. Therefore, a museum exhibition program should be based largely on an interdisciplinary synthesis of scientific knowledge. We will of course need introductory exhibition areas where basic scientific laws and concepts can be illustrated, thus making the other exhibition areas more meaningful. We must provide space within our permanent halls or in specially designated exhibit areas where we can illustrate new and timely scientific interpretation, and if possible, how this interpretation may directly or indirectly affect modern man. We can show in our temporary exhibits and to some extent in our permanent halls the processes of culture change and explain these processes in detail. We can use our ethnographic collections to make comparisons of past culture change to illustrate what is happening to modern man. We can humanize our exhibits by having representatives of various ethnic groups demonstrate their arts and crafts in our halls, as was the case in Field Museum's American Indian Festival, September 1968 and in our Fiesta Mexicana, September 1969.

In addition, the special programs that accompanied the Festival exhibits—such as film and lecture series as well as dance progams—made our otherwise static exhibits come alive. We should include other media, such as slides and loop film projectors in our permanent halls to illustrate aspects of animal behavior or to illustrate natural processes that are difficult to explain in a static manner.

Coupled with all of these new innovations in exhibition approach and interpretation we must somehow still provide the visitor in our exhibition halls a source of wonder and delight for mind and heart.

The new philosophy with new objectives, including proper interpretation, must evolve if natural history museum exhibits are to fulfill their obligations in a changing world. Above all, this new philosophy of contemporary relevance should arouse moral and financial support. It must reflect the idea that we, as institutions of higher learning, must bring to the public we serve an appreciation and understanding of the significance of current thinking in the natural sciences by seeing them applied to the interpretation of our endangered environment as well as to our current culture change, with which the public should be deeply concerned. Natural history museum exhibits have been so

This photo-display in the 75th Anniversary exhibit expresses "A Sense of Wonder" at the uniqueness and diversity of man.

This unique display case, constructed from a concrete pipe is from Field Museum's exhibit, "Illinois by the Sea." The exhibit tells the story of the effects of overcrowding on living things.

preoccupied with the wonders of idealized nature that they have tended to neglect the importance of nature as the priceless environment of man and the foundation of his existence. We must, therefore, look at the entirety and base our thinking on the ideal that museums should influence man's rational attitude toward nature in the next five to thirty years. This should be our foremost mission.

Besides housing exhibits, museums have also established themselves as community centers, a meeting place for clubs, musicals, films, flower shows, etc.; this is probably truer of the smaller institutions than many of our larger museums. However, it is in this area that museums could do more to accomplish relevant ends. By tying in special lectures, films, discussion forums with special exhibits, of a timely nature, the museum would be fulfilling a greater role in the community.

Another area to be developed is the satellite museum or museums. This is a function that institutions in the larger urban areas should explore. As cities increase in population, the ratio between population and attendance, exhibit space and expenditure at museums in single centers tends to decrease. This places a serious limit on the social influence of the museum. A parallel may be drawn between the public museum and the public library. Their histories have been similar with the latter reaching a more advanced stage in development. Prior to 1900 both the libraries and museums were centralized. Both rendered a free cultural service and depended on community interest and financial support. As the cities grew, accessibility became increasingly difficult and other activities competed for public attention. Combating these negative conditions the public libraries decentralized, establishing branches in more remote areas of the city. Not only did book circulation increase, but also the expenditure per capita of population rose. If museums decentralize, by setting up satellite branches, as did the libraries, they would more effectively fulfill their role as educational institutions. The main problem in achieving these ends is the overall lack of funds.

We know that the establishing of a new philosophy and new objectives for all natural history museums is mandatory if we are to survive and fulfill our social responsibilities as public institutions. We must also be able to move and shift with the social needs of society as major events occur. As difficult a task as this may seem, our new philosophy must somehow reflect this aspect of flexibility and also communicate our desire to be modern institutions at all times. At the same time, we should continue to stress the traditional qualities museums had in the past, namely, that the visitor is free to see as much or as little as he wishes, and that he can experience different parts of the real world.

To quote again from Alvin Toffler: "We have taught ourselves to create and combine the most powerful of technologies. We have not taken pains to learn about their consequences. Today these consequences threaten to destory us."

Natural history museums have a social responsibility to be relevant and contemporary and help save man from himself!

As visitors leave Field Museum's "Illinois by the Sea" exhibit, they are confronted with a group of suspended tubes warning of the possible effects of overcrowding on living things.

The Barabaig; East African Cattle-Herders
by George J. Klima
New York (etc.),
Holt, Rinehart and Winston, 1970

The Kwakiutl; Indians of British Columbia
by Ronald P. Rohner and
Evelyn C. Rohner

The Pueblo Indians of North America
by Edward P. Dozier

The Zinacantecos of Mexico; A Modern Maya Way of Life
by Evon Z. Vogt

These are four of the newest volumes in the series *Case Studies in Cultural Anthropology*. This series, now numbering over forty-five volumes, is intended primarily for students in beginning and intermediate courses in the social sciences but is also of great interest to the general reader. Each volume is designed to give "insights into the richness and complexity of life as it is lived in different ways and in different places." Each author has lived in the society he writes about, is a professionally trained observer and interpreter of human behavior, and is a teacher. The volumes are issued softbound and are moderately priced.

The present volumes more than meet the specifications of the series and are highly recommended. Klima's work on the Barabaig is a valuable study in cultural ecology. The Rohners' book on the Kwakiutl and Vogt's on the Zinacantecos depict cultures that have retained much of their social and cultural identity despite many changes and difficulties. Dozier's work is unique in that it is concerned with a group of related peoples rather than a single one. The Pueblo Indian cultures have been of particular interest to anthropologists for many years. This study of their adaptation through time to changing conditions is a welcome addition to the literature.

A Guide to the Native Mammals of Australia
by W. D. L. Ride,
with drawings by Ella Fry
Melbourne (etc.), Oxford University Press, 1970

This is a most interesting and well-written, well-illustrated introduction to the fascinating mammals of Australia. It differs from the usual book of this sort in that the author is as much concerned with the problems of conserving the mammals as he is with describing them. He prefaces the descriptive part with a discussion of the principles, historical and environmental, that have resulted in the distribution of the different kinds of Australian mammals and of the changes that are altering these distributions. Dr. Ride, director of the Western Australian Museum and a noted mammalogist, has written this book for the general reader and provides in an appendix some "Suggestions for further reading." But it will also be of value to students and for these the author has provided an appendix "For the student and professional user."

Whose What? Aaron's Beard to Zorn's Lemma
by Dorothy Rose Blumberg
New York (etc.), Holt, Rinehart and Winston, 1969 ($3.95)

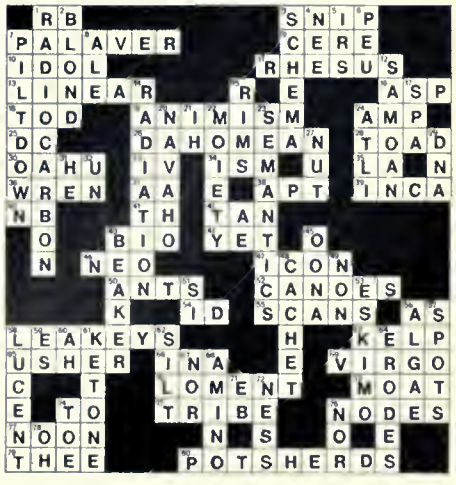
This little book fills a gap on the reference shelf and will be a boon to those who seek the exact meaning and derivation of such expressions as Gresham's law, Hobson's choice, King Solomon's ring, and Mother Carey's chickens. The author/compiler has set certain criteria for the items she has included: the "who" must be a real or legendary person; the "what" is something named, either literally or figuratively. Many areas are covered, including mythology, natural history, mathematics, medicine, and history. Some of the expressions are well known and fairly obvious—Lot's wife, Wilson's fourteen points—others are more recondite—Poisson's ratio, Zorn's lemma. But all are interesting and the book is a mine of little-known facts. I particularly enjoyed "Maxwell's demon": "A tiny imaginary creature used in 1866 by the Scottish physicist James Clerk Maxwell . . . to illustrate how it is theoretically possible to thwart the second law of thermodynamics."

Proceedings of the Apollo 11 Lunar Science Conference, Houston, Texas,
January 5-8, 1970
edited by A. A. Levinson.
New York, (etc.), Pergamon Press, 1970. (Supplement to vol. 34 of *Geochimica et Cosmochimica Acta*), 3 vols.

Definitely not for the layman but a landmark publication in lunar science. The Museum's Curator of Mineralogy, Dr. Edward J. Olsen, is among the contributors.

by W. Peyton Fawcett, head librarian, Field Museum

Answers to last month's crossword



FIELD BRIEFS

Dr. Wenzel New Zoology Department Chairman

"My interest in natural science goes back to high school days when a fine zoology teacher encouraged our class to make a good insect collection," says Dr. Rupert L. Wenzel, Field Museum's newly appointed Chairman of the Department of Zoology.

No stranger to the Museum, having worked as a volunteer in the Division of Insects in 1934-35, Dr. Wenzel joined the staff as Assistant Curator of Insects in 1940. He has served as Curator of Insects since 1950.

The author of many technical papers dealing with systematics of beetles and bat parasites, as well as encyclopedia articles and popular articles on insects, Dr. Wenzel was decorated by the President of Panama in 1967 for producing, with co-editor Dr. Vernon J. Tipton, *Ectoparasites of Panama*, a 816-page book on the classification and biology of blood-sucking external parasites of mammals of Panama. The book, produced under a U.S. Army grant and published by Field Museum, has been distributed to parasitologists and public health agencies throughout Latin America and elsewhere.

One of three recognized scientists in the world possessing expertise on the classification and biogeography of Histerid beetles, Dr. Wenzel is presently revising a manuscript to be published in 1971 which will provide a detailed analysis of the zoogeography of these beetles in Eurasia and North America. Together with their purely scientific interest, Histerid beetles, which are distributed throughout the world, are valuable for biological control purposes.

Reflecting on the past 30 years at Field Museum, Dr. Wenzel recalls the acquisition of the Bernhauer collection in 1951 as the most exciting effort he has engaged in. Dr. Max Bernhauer, a Viennese public official who began studying and collecting Staphylinidae (Rove) beetles before the turn of the century, had described over 4,900 new species and amassed more than 100,000 specimens before his death in 1946.

After arrangements had been made to purchase the collection from Bernhauer's daughter, Dr. Wenzel traveled to Austria in 1951 to oversee the packing and shipping of what is recognized as one of the most important zoological collections ever brought to the United States.

In addition to his work at the Museum, Dr. Wenzel is a Lecturer in biology at the University of Chicago and a Research Associate in biology at Northwestern University. He is Editorial Advisor in entomology for Encyclopaedia Britannica and represents the Entomological Society of America as a council member of the American Association for the Advancement of Science.

A native of Owen, Wisconsin, Dr. Wenzel makes his home in Oak Park where, as an elected village trustee from 1961 to 1969, he helped bring about many of the community programs which have been realized in Oak Park in the last decade.

Dr. Wenzel succeeds Dr. Austin L. Rand who retired as Chief Curator of Zoology on October 23.

Photo by Edmund Jarecki

Dr. Rupert L. Wenzel

AAAS Short Courses

A series of short courses for college teachers of the natural sciences will be conducted by the American Association for the Advancement of Science in November 1970 and February 1971. Supported by the National Science Foundation, sessions are scheduled at Field Museum, the University of Maryland, Clark College in Atlanta and the University of Texas. Donald C. Edinger, chairman of the Department of Education at the Museum, is Coordinator of the Chicago sessions.

A Christmas Afternoon

"A Christmas Afternoon at Field Museum," from 4 p.m. to 7 p.m., December 21, will be a time for bell-ringing, caroling and dancing to the lively tunes of Leo Henning and the Lou Breese orchestra. The scene for the festive occasion is Stanley Field Hall, where a sparkling, 20-foot Christmas tree will provide the appropriate holiday atmosphere for the entertainment program. Refreshments will be served.

Tickets are $10 for adults and $5 for children, and are available through the Women's Board of Field Museum, sponsors of the event.

Demonstration Lecture

Eric M. Rogers, professor of physics at Princeton University, will give a demonstration-lecture on "Measuring Air Molecules" or "Why should people believe what scientists tell them about molecules and atoms?" at 3 p.m., December 27, at Field Museum.

The free program consists of a series of demonstration experiments and a discussion of how the experiments provide information about molecules. The demonstrations will show measurements of air pressure and air density. Liquid nitrogen will be used to show the existence of molecular forces, and then to estimate the spacing of molecules in ordinary air. An experiment with visible gas will lead to an estimate of collision distance and size of air molecules.

The program is offered as a popular lecture of demonstration experiments, appealing to an audience with serious scientific interest.

A limited number of seats have been set aside for Field Museum members. Applications for tickets should be made before December 1 to the Department of Education, Field Museum.

Exploring Indian Country

Field Museum's Winter Journey "Exploring Indian Country," December 1 through February 28, enables youngsters to see American Indians of three environments as the explorers saw them. By following a self-guiding tour through exhibit areas, they learn how the Indians obtained their food, made their clothing and homes, traveled, and what animals they depended upon for their existence.

The free program is offered to all boys and girls who can read and write. Journey sheets are available at Museum entrances.

CALENDAR

HOURS

9 a.m. to 4 p.m., Monday—Thursday
9 a.m. to 9 p.m., Friday
9 a.m. to 5 p.m., Saturday and Sunday

The Museum Library is open
9 a.m. to 4 p.m.
Monday through Friday

Opens November 18

A Child Goes Forth, an exhibit of toys and games from around the world, exploring the role played by these objects in the cultural development of children. Hall 9.

Continuing

"Eye" Spy, Fall Journey for Children, designed to help boys and girls who can read and write to develop and practice their powers of observation. Free Journey sheets are available at Museum entrances. Through November 30.

Corn Blight, a display showing the effects of a virulent new strain of Southern Corn Leaf Blight disease. This disease is responsible for a predicted 18% decrease in this year's crop. Through January 18. South Lounge.

75th Anniversary Exhibit: A Sense of Wonder, A Sense of History, A Sense of Discovery, offers a new experience to museum-goers. Innovative photographic and display techniques explore the many facets of Field Museum. Hall 3.

John James Audubon's elephant folio, *The Birds of America*, on display in the North Lounge. The rare, first-edition set is installed so that a different plate is featured each day.

November 8

Chicago Shell Club presents Dr. Alan Solem, curator of lower invertebrates at Field Museum, in a slide-lecture on "The Giant African Snail Invasion of Florida." 2 p.m., Lecture Hall.

November 15

Wildlife film, "Outback Australia," offered by the Illinois Audubon Society. 2:30 p.m., James Simpson Theatre.

Fall Film-Lecture Series

Saturdays at 2:30 p.m.
James Simpson Theatre

November 7

"High Himalaya"
by Russ Potter

A visit to West Pakistan, Gilgit, Hunza and Nagar, located in a spectacular mountainous setting, offers an exciting film adventure.

November 14

"Waterbirds of the African and Asian Tropics"
by Dr. M. P. Kahl

A film-study of the behavior and breeding habits of rare and exotic birds, photographed in their natural environment.

November 21

"Highlights of New England"
by John Roberts

Historic sites, famous seaports, the beautiful countryside and quaint towns as seen during various seasons.

November 28

"Yugoslavia"
by William Sylvester

The journey includes Zagreb, Belgrade, Dubrovnik, the magnificent Adriatic Coast and Sarajevo, contrasting the old with the new.

Field Museum's Natural History Tours

Gardens
Wild flowers
Birds
Archaeology
Congenial travel companions
Interpretations by experts
The unhurried approach
Travel with all dimensions

THE INCA'S EMPIRE & DARWIN'S GALAPAGOS
Two sections: Dec. 31–Jan. 29, 1971, & Feb. 4–March 5.
$2,807 includes $600 donation.

(22 days of Andes, $2,457; 11 days of Galapagos cruise & Quito, $1,190—separately) Gardens in Bogota, Lima, La Paz, Quito. Ruins of Machu Picchu, Chan Chan, Pachacamac, Cajamarquilla, Ollantaytambo, Cuzco, Lake Titicaca, Tiahuanaco. Spanish Colonial art & architecture in Colombia, Peru, Bolivia and Ecuador.

TOUR ARCHAEOLOGISTS: Dec. 31-Jan. 29, Dr. Donald E. Thompson, associate professor of anthropology, University of Wisconsin and leading interpreter of Peruvian and Incan archaeology. Feb. 4-March 5, Dr. Carlos R. Margain, prominent Mexican archaeologist and officer of Mexico's Museo Nacional de Antropologia, specialist in Mexican and Andean archaeology.

GALAPAGOS NATURALIST, with both Galapagos tours and in Ecuador, Francisco Leon Rodriguez, formerly of the Darwin Research Station and now zoologist with Universidad Catolica in Quito.

LEADER ON ALL TOURS, PHIL CLARK, former Editor of Horticulture magazine; former Garden Editor of The News, Mexico; author, "A Guide to Mexican Flora"; Field Museum Natural History Tours Chief.

All donations to Field Museum are tax deductible.
Rates are from Chicago; may be adjusted from other points.

Write: Field Museum Natural History Tours
Roosevelt Rd. at Lake Shore Dr.
Chicago, Ill. 60605

Volume 41, Number 12 December 1970
Field Museum of Natural History

BULLETIN

BULLETIN

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Director, E. Leland Webber

Editor Joyce Zibro; **Associate Editor** Victoria Haider; **Staff Writer** Madge Jacobs; **Production** Russ Becker; **Photography** John Bayalis, Fred Huysmans.

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LETTERS

To the editor:

A friend has called to my attention the interesting article on "The Vanishing Peregrine" in your September number. I am, however, surprised to read near the top of the third column on page 6 the assertion that "In low doses, DDT effects breeding success."

If this statement is true, then exposure of birds to "low doses" of DDT ought to be strongly encouraged, in order to effect breeding success. This conclusion would seem to contradict the remainder of the article.

Can it be that the author and/or editor have failed to note the fundamental distinction between "effect" and "affect," resulting in a statement which means exactly the *opposite* of what was intended? If so, you owe your readers a prompt correction before they start extolling the virtues of DDT in effecting breeding success! As a matter of fact, "reduce" would be much better than the non-commital "affect" if that is the direction in which DDT affects the situation.

Edward G. Voss
Curator and Professor,
University of Michigan

Editor's note: We stand corrected. Thank you.

To the editor:

Usually I enjoy the articles in the *Bulletin* as authoritative, well-written, yet nontechnical descriptions of some interesting phenomenon or problem in nature. I was therefore disappointed on reading the article by Dr. Paul R. Ehrlich, "The Population Crisis: Where We Stand," to have a growing sense that it was unworthy of the *Bulletin*. It read to me like a political speech full of demagoguery designed to appeal to the passions in a highly excited audience not like a dispassionate, scientific, or reasonable analysis of the critical problems mankind faces in its utilization of the earth's resources or in the appropriate relationship of population size and stability of the earth resource system, or environmental quality.

Articles such as the superb discussion of the peregrine falcon, *si;* articles such as Dr. Ehrlich's mishmash, *no!*

Dr. Chauncy Harris
Professor of Geography
University of Chicago

To the editor:

Dr. Paul R. Ehrlich's doomsday address of June 11, 1970 (printed in the Museum's October *Bulletin*) in which he explicated his views respecting the imminent disaster man has created for himself by overpopulation and a related disruption of earth's ecology, would be more persuasive and helpful IF:

there were more facts and less rhetoric,
the rhetoric were less biased and inflammatory,
the logic were not so contradictory,
the adjurations respecting remedial action were more honest, and
the author's understanding of the nature of human nature were more sound, but

were these aberrations corrected the tone and content of his theses would be quite different from the sensational curiosity his address launched.

Other "experts" must have some different assessments of the problem that so stirs Dr. Ehrlich or at least, one would hope, more rational and convincing suggestions for dealing with it; and now that we've been terrorized and chastised by Dr. Ehrlich's strictures, can't we have a sampling of other views?

Dean Terrill
Chicago

To the editor:

Hearty congratulations on the improved *Bulletin!* It gets better each issue as it goes from strength to strength.

Hughston M. McBain
Honorary Trustee, Field Museum

To the editor:

As a former member of the Field Museum, I have long been familiar with the *Bulletin,* and while in Chicago I read it with considerable interest. I enjoyed keeping track of Museum events and sharing the knowledge which equips so many members of the Museum staff to write in an engaging vein about their particular field of interest. When I left Chicago I let my membership lapse, sorry that I would no longer be able to take advantage of Museum activities.

From time to time, however, I manage to borrow copies of the *Bulletin,* and I have been so impressed with the quality of feature articles of late that I would like to renew my subscription. Pieces like those by Loren Woods ("The Changing Great Lakes," July & August issues) and Paul Ehrlich ("The Population Crisis: Where We Stand," October issue) represent a noble attempt on the part of the Museum to increase the amount of public concern over the course of "natural" history; indeed, this sort of concern is essential if—in the future—institutions like the Field Museum are to have anything worth preserving! I congratulate you and your staff on the selection of these articles and look forward to receiving the *Bulletin* once again. I realize that "opinions expressed by authors are their own and do not necessarily reflect the policy of the Field Museum," but I do feel it is to your credit to listen to (and spread) the voice of wisdom.

I am enclosing a check for $20, and hope that the membership fee will allow for part of that amount to be considered a contribution.

Paula S. Barker
Editor, *African Studies Newsletter*

Editor's note: In the article "Turtle Lore: Fact and Fiction," which appeared in November's *Bulletin,* line 19, column 2 on page 9 should read "Cretaceous Period, and was perhaps."

Please address all letters to the editor to

Bulletin
Field Museum of Natural History
Roosevelt Road and Lake Shore Drive
Chicago, Illinois 60605

The editors reserve the right to edit letters for length.

SNOW

Dr. Edward J. Olsen

As the season of many holidays comes upon us stores and shops begin to decorate their windows and showcases. A popular decorative motif, the snowflake, serves equally well for all the winter holidays. As I walk through the Loop and see the large, multicolored paper "flakes" on store windows or on gift wrapping paper and greeting cards, I often wonder about the persons who design such decorations. Like many people, they must look at Nature but never really see her, otherwise I would not see so many five, seven, eight, and occasionally nine or ten-sided "flakes." Many of them, of course, get it right and show flakes with six sides—just as Nature makes them almost all of the time. Occasionally, however, in the haste of putting together a quick sleet storm, Nature will produce a variant that is quite small and only three-sided.

Snowflakes, the joy of children, are an artistic delight to their elders, when they care to really see them; hexagonal white filigrees, in a myriad of patterns and variants of these patterns. Although the notion seems strange to most people, snow is a part of the mineral kingdom. Any mineralogy book that attempts to be complete will list *ice* and note that it crystallizes with hexagonal symmetry. When ice crystallizes it must start small and then grow. The first part to form is called a *nucleus,* which is a minute clustering together of molecules. Frequently this process of nucleation is promoted by a speck of dust, onto which the first molecules attach themselves. The nucleus grows by attaching passing molecules in the symmetrical arrangement that fits the geometry of the molecules and the forces that hold them together.

If we could watch the process through a microscope we would see six spokes grow outward, thin arms branch across them, the spokes gradually thickening, sometimes forming smaller hexagonal terminations, and so on and so on, no two making exactly the same pattern. If the process were to continue to completion, all the angles between the spokes would fill in and we would have a simple prism, bounded by six sides and two flat ends. When ice forms at sea this indeed happens, but fortunately snow never has time to complete the process before it lands on the ground. Thus, snowflakes are the skeletons of ice crystals.

Early winter snows usually occur when the temperatures are not yet too far below 32°F. At such temperatures the amount of moisture the air can hold is much larger than at very cold temperatures, such as below 10°F. Thus, near 32°F snow crystals have a relatively abundant water supply and grow fat and large, and frequently stick together in fluffy clusters. Later in the winter when extreme cold sets in, the air can hold only small amounts of moisture and the snow flakes are small, poorly shaped, and frequently jagged, making for sharp edges and considerable discomfort when walking into the wind. Early spring snows again are fluffier due to the warming trends at that time of year.

You have probably noticed that when the first snow comes, when it is still not too cold, the air seems to warm up slightly during the snowfall period. This is not just your imagination. When many large skeletal crystals of snow form in a relatively short period of time each one gives off a quantity of heat as it transforms from water-moisture (a gas) into crystalline ice (a solid). All substances do this. In the case of snow the heat is equivalent to about 250 calories (as food calories are figured) for each pound of snow crystals formed. You feel this as a gentle warming of the air. Later in the season, during colder days, such heat is also given off but it is not sufficient to make any sensible effect on the bitter cold temperatures of deep winter.

As Earth-dwellers we are blessed with water in its three forms, as a gaseous vapor in the air, as a liquid in seas and lakes, and as a solid in snow and ice. All three forms add beauty and variety to our lives. Now that we have some idea of the conditions on other planets in our solar system we realize that such variety is unique. On far out planets like Saturn and Neptune, liquid and gaseous water would be laboratory curiosities. Only ice would represent any water that happened to be there. On the other hand, on a planet such as Venus, any water would be present only as a gas in minute amounts in the atmosphere. Ice would never form in the raging heat on its surface. On the barren surface of Mercury, *any* form of water is virtually impossible.

When the snow comes this year, fairly soon now, it creates a quiet sense of peace, which is wholly appropriate to the spirit of the holidays before us.

Dr. Edward J. Olsen is Curator of Mineralogy in Field Museum's Department of Geology.

Southern Corn Leaf Blight

Dr. William C. Burger

In August of this last summer the Southern Corn Leaf Blight reached the heart of the corn belt. This disease survives the winter in the south and travels by spores northward with warmer weather. The blight has been known for over 50 years but this year it was different; it had developed a new strain. This new strain probably developed from a mutation within the population of the older disease which is still around. These are plant diseases; they do not infect humans, though some people are allergic to the spores.

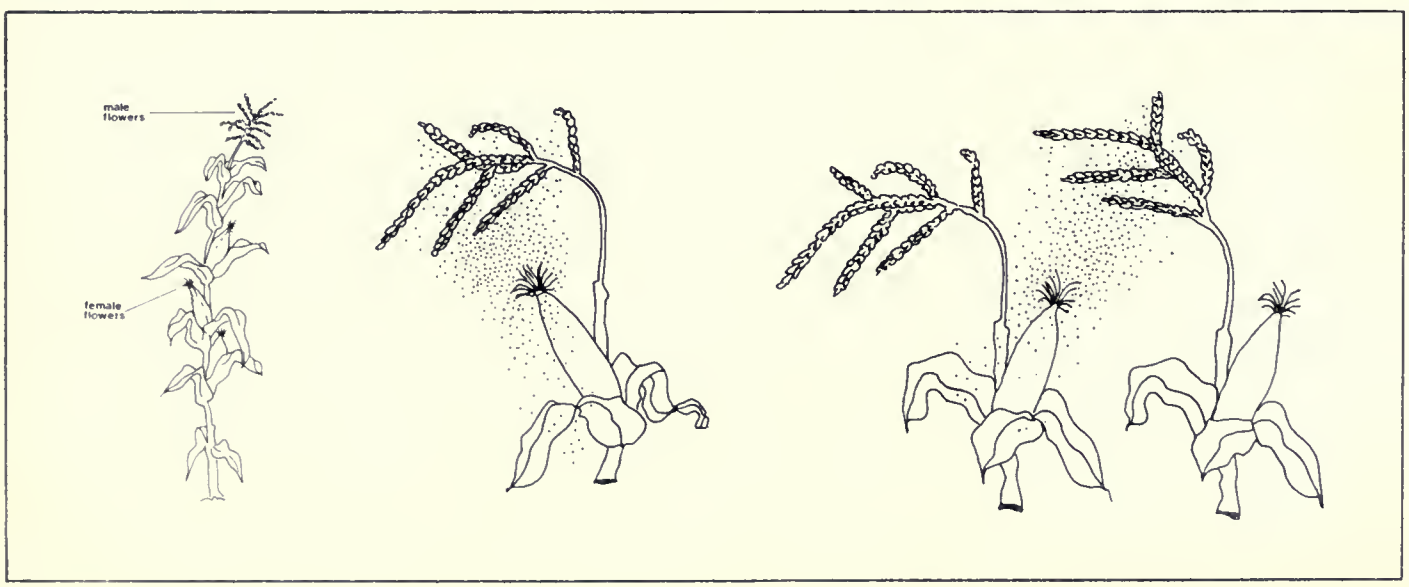
A plant disease uses the tissues and energy of the host for its "own ends" —which is what every disease does. This blight is a fungus whose thread-like tissue grows into the host plant. The fungus uses the corn plant to make more fungus and thus there will be less corn-plant after an attack of this disease. The Department of Agriculture estimates that the new disease caused an 18% weight reduction in the corn crop this year. Most of this corn is used for feeding livestock but it is also used for numerous other products, such as flour, starch and oils. But no matter what the product, this disease will end up costing the consumer money.

This series of photos, taken over a period of 14 days, shows the damage on a leaf sheath attacked by a new strain of Southern Corn Leaf Blight.

Courtesy Chicago Tribune

The corn plant is unusual in having both the male and female flowers on the same plant, but in different parts (see illustration on left). The female flowers are in the ear and produce the seeds, or kernels. The male flowers produce only pollen and are found in the tassel at the top of the plant. The second illustration from the left, and the two on the right represent the two different types of pollination. In the second illustration, which shows self-pollination, the pollen from the tassels drops onto the silks of the same plant, and thus pollinates itself. The illustrations on the right demonstrate cross-pollination, in which the pollen from one plant fertilizes the female flower of another plant.

Illustration by Zbigniew T. Jastrzebski



This new strain of the Southern Corn Leaf Blight packs a bigger wallop than the older disease and affects many parts of the plant. While the kernels are usually not themselves diseased, Blight in stem and leaves will cause the kernels to be much smaller than usual. But more important is the fact that most hybrid corn is particularly susceptible to this new disease. Some types of corn are resistant to the new disease, but not hybrid corn with male-sterile cytoplasm of the Texas type. To make sense out of "male-sterile cytoplasm" let's start with "male-sterile." Hybrid corn is especially productive because it is the product of two genetically different parent plants. It adds up the best qualities of both parents, so to speak. To produce hybrids, the mother plant (which produces the seed) must not pollinate itself. The pollen must come from a genetically different plant. In the past people had to cut off the tassels (which have the male flowers that produce pollen), of the seed plant. This prevented the seed plant from pollinating itself. When male-sterility was discovered, it did away with much of this hand labor and reduced the cost of hybrid corn. A plant with male-sterility does not produce functional pollen and hence cannot pollinate (or fertilize) itself—the same effect as cutting off the tassels.

Cytoplasm, the part of the cell contents outside the nucleus, usually plays little or no role in heredity. But in this case the cytoplasm of the Texas type does carry the susceptibility to this new corn disease. The sperm cell and pollen grain (male sex cells) contribute almost no cytoplasm in fertilization—they contribute a nucleus with its chromosomes. Thus cytoplasm is largely inherited from the mother through the egg cell, or female sex cell.

Because of this unusual form of inheritance, plant breeders estimate that it will take six generations to produce low cost seed for hybrid corn that is resistant to this new disease. Agricultural experts have already left for Puerto Rico and Hawaii to use those warm tropical areas in an attempt to produce five generations in this next year. Then hopefully, seed companies will be able to produce low cost seed for the growing season of 1972.

But this new resistant seed will not be the end of the story. The disease may change again in the future and plant breeders will again have to find and breed new types of resistant corn. The same story is true for the wheat rust diseases. These diseases are always changing and the plant breeder must find resistant plants and then breed this resistance into the cultivated high yield plants that produce our food.

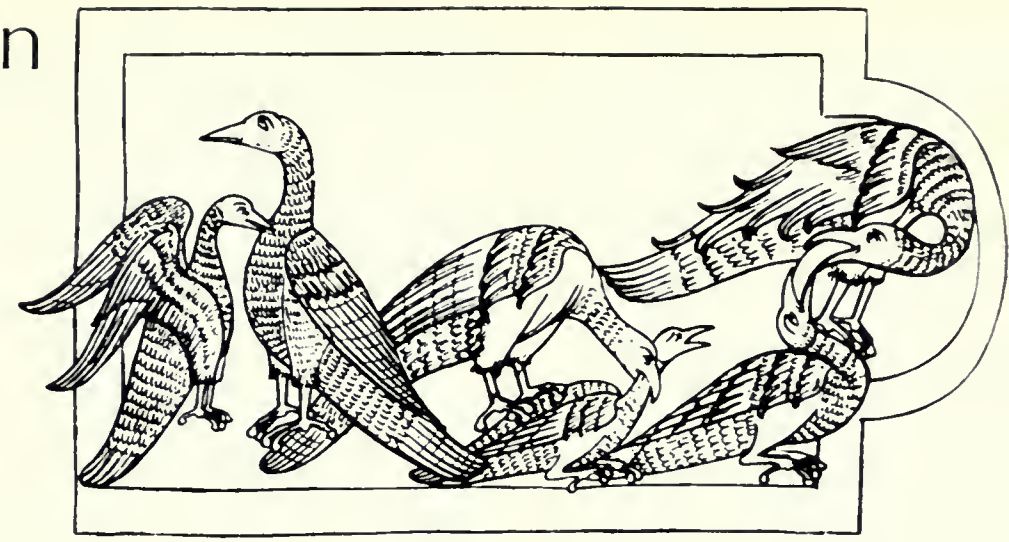
Nature is not stable and never was, except in a very general sense. The processes that we observe in plant diseases have gone on for millennia. The process of selecting plants resistant to diseases has taken place in nature—but the selection process may be much slower than in modern agriculture.

If there is any moral to be drawn from this story of the Corn Blight disease it is this: we must preserve diversity in our cultivated plants. When a new disease strikes, the plant-breeder must be able to find resistant plants so that he can breed this resistance into our agricultural varieties. Agricultural science has the know-how to accomplish miracles through plant-breeding—but if the diversity is lost the know-how will be useless. Agricultural institutions are getting together to maintain large collections of different varieties of cultivated plants. These living collections are a kind of banking system for genetic diversity. These banks are our best investment in the never-ending fight against the diseases of our cultivated plants.

Dr. William C. Burger is Assistant Curator of Vascular Plants in the Department of Botany at Field Museum.

The dramatic difference between normal and diseased ears of corn can be seen in this photo. The ears on the right were attacked by the new strain of Southern Corn Leaf Blight.
Courtesy Chicago Tribune

pious pelican



These are illustrations of the pelican from The Book of Beasts *(translated by T. H. White). Note that the young bird on the right is being revived by a gush from the mouth and not, as described in the text, from the breast.*

W. Peyton Fawcett

Pie Pellicane, Jesu Domine,
Me immundum munda tuo sanguine.
(Pious Pelican! O Jesu Lord!
Unclean I am, but cleanse me in Thy blood!)

These words from the sixth stanza of the famous "Rhythm" of St. Thomas Aquinas *(Adoro Te)* have intrigued me for a number of years. I recall reading them for the first time during the Christmas holiday and every year, as the season approaches, they return to my mind. Each time I'm struck anew by the seeming incongruity of the pelican being used as a symbol of Jesus Christ and wonder what it could be in the appearance, habits, or history of the bird that led to the relationship. This year I have had occasion to satisfy my curiosity and have, in the process, turned up some fascinating information.

The pelican is popularly known today as an ungainly bird with an enormous pouched bill and thought of as more of a caricature than a living bird. This attitude is summed up in Dixon Lanier Merritt's justly famous limerick:

A wonderful bird is the pelican,
His bill will hold more than his belican,
He can hold in his beak
Enough food for a week,
But I'm damned if I see how the helican.

But our forefathers had an altogether different view. They believed that the pelican "turneth her beak against her breast and therewith pierces it till the blood gusheth out, wherewith she nourisheth her young." Shakespeare had this curious legend in mind when he has Laertes say (Hamlet, IV, 5):

To his good friends thus wide I'll ope my arms,
And, like the kind life-rendering pelican,
Repast them with my blood.

This legend is a very ancient one and has persisted down to recent times. To account for it ornithologists and others have propounded very ingenious theories. One argues that during the feeding process the red nail or tip of the lower mandible of the pelican, pressing against the breast might lead the observer to suppose the bird was piercing its breast. Another asserts that in order to eject the contents of the pouch, the bird presses its bill strongly and with a kind of spasmodic action against its breast, and the pinkish hue of its feathers, the red tipped bill, and often enough of the blood of its captured victims, combine to produce the effect that gave birth to the legend. A Mr. A. D. Bartlett suggested in 1869 that the legend really applied to the flamingo which he said does eject "a curious bloody secretion from the mouth."

Whatever the merits of these arguments they can safely be overlooked, for the bird of the legend may be neither the pelican nor the flamingo. The name pelican seems in ancient times to have been applied to several birds noteworthy for their bills and derives from a Greek word signifying "to hew with an axe." The pelican of Aristophanes, for instance,

was the woodpecker, so-called because of its pecking. The spoonbill and the true pelican were also "pelicans," the former because of the remarkable shape of the bill and the latter because of its size. It is certain that other birds also bore the name. Oddly enough, the true pelican was called "Onocrotalus" by most ancient writers, including Pliny.

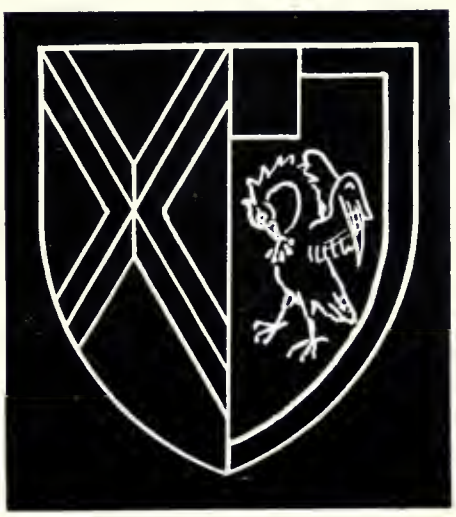
William Houghton, in his *Gleanings From the Natural History of the Ancients* (London: 1879) suggests that the legend refers to a vulture or eagle, and cites the story of Horapollo that the vulture, if it cannot get food for its offspring, opens its thigh and allows them to partake of its blood. He thinks that the story was adapted and magnified from this Egyptian fable by the early Church fathers in their annotations of the scriptures. He quotes St. Augustine's statement that the male pelicans "are said to kill their young offspring by blows of their beaks, and then to bewail their deaths for the space of three days. At length, however, it is said that the mother bird inflicts a severe wound on herself, pouring the flowing blood over the dead young ones, which instantly brings them to life." Many other writers relate the same story with minor variations. Another version states that "Pelecani, when they find their young killed by a serpent, mourn, and beat themselves upon their sides, and with the blood discharged, they thus bring back to life the bodies of the dead."

T. H. White, in his wonderful translation of a Latin Bestiary of the twelfth century, *The Book of Beasts* (London, 1955), gives us still another version, very similar to that of St. Augustine. This author states that the pelican is "excessively devoted" to its children but that when they grow up, the young flap their wings in their parents' faces. The parents, striking back, kill them. After three days the mother pierces her breast, opens her side, and pours her blood over the dead bodies, bringing them back to life. This author points the moral thusly:

> In the same way, Our Lord Jesus Christ, who is the originator and maker of all created things, begets us and calls us into being out of nothing. We, on the contrary, strike him in the face. As the prophet Isaiah says: "I have borne children, and exalted them and truly they have scorned me." We have struck him in the face by devoting ourselves to the creation rather than the creator. That was why he ascended into the height of the cross, and, his side having been pierced, there came from it blood and water for our salvation and eternal life.

These then are the sources of our symbol; the complex of ideas and emotions behind St. Thomas' invocation of the "Pelican of Mercy." The pelican is a symbol of Christ's love for men. With the substitution of the true pelican for whichever bird the earlier writers had in mind, it continues to exist to the present day in ecclesiastical art.

This symbolism was carried over into heraldry, and the pelican, as a type of Christ, was and still is popular with churchmen. In early heraldry the pelican is often drawn more like an eagle and is almost invariably depicted "in her piety," that is, piercing her breast and surrounded by the young in



The pelican symbol was used by Richard Foxe as Bishop of Bath and Wells in his arms.

the nest whose mouths are opened to receive the blood. The author of the article on "Heraldic Birds" in Sir A. Landsborough Thomson's *A New Dictionary of Birds* (New York, 1964) gives us a well-known example of the pelican in heraldry: the "Arms of Richard Foxe, Bishop of Winchester (died 1528), Azure a Pelican wings elevated and addorsed (back to back) Or vulning (wounding) herself proper."

More than one cardinal adopted the pelican in his armorial bearings, and we find Henry VIII changing the three cranes, which were a part of Archbishop Cranmer's arms, into three pelicans, for the reason that "these birds should signify to him that he ought to be ready, as the pelican is, to shed his blood for his young ones." That, unfortunately, was what the Archbishop later had to do.

Carl G. Jung has taught us that a symbol is more than a substitute for, or a representation of, the real thing; it carries a wider meaning and cannot be precisely formulated. Most of us can no longer grasp the full meaning or feel the power and beauty of the pelican as a symbol. It is rooted in another age, an age of faith, a time when men felt that the world was governed by a controlling Mind and capable of rational explanation. Everything meant something and fitted into a pattern. Everything concealed a hidden meaning that could be understood by faith. People could still expect to "Ask now the beasts, and they shall teach thee; and the fowls of the air, and they shall tell thee" (Job, XII, 7). But St. Thomas' world is not ours and, besides, we could never forget that blasted limerick!

W. Peyton Fawcett is Head Librarian at Field Museum.

ANOTHER VIEW OF THE ELEPHANT

Alan Solem

We live in a world of instant communication and constant social turmoil, where ideas or suggestions expressed in London or New York today may echo in Tokyo or Sydney tomorrow, and where no institution, idea or ideal is safe from challenge. We live in a very complex world of choices, trivia and great needs, where a desire for air-conditioned summer comfort can be satisfied only by an increase in air pollution from the generation of more electricity, and where poverty plus hunger must compete for attention with the threat of nuclear holocaust and the battle of the hemlines.

The simple slogans and easy choices of yesterday are replaced by rejection of old values, calls for contemporary relevance and a search for new solutions. Because major problems remain unsolved, a natural cry is heard for change in existing institutions to meet the great problems of today. "Museums in a Changing World" by Lothar Witteborg, printed in the November *Bulletin,* summarizes some of the current ideas about museums in regard to their direct public services. It proposes "contemporary involvement and immediacy" in the problems of today. The goals of service to society are exemplary, but how best can a natural history museum serve? In his autobiography, Harlow Shapley, the famous astronomer of Harvard University, wrote concerning his early career, "I realized that I could do things other people could not or would not do, and therefore I was useful."

What can a natural history museum do that other institutions cannot or will not? Where can we be useful? There will be as many views of this as by the protagonists in John Godfrey Saxe's "The Blind Men and the Elephant." Since the fighting elephants in Stanley Field Hall for half a century have been our symbol to the public, this parable has contemporary relevance. Six blind men came near an elephant. Each man blundered into a different part—side, trunk, tusk, knee, ear and tail. Each man thought his one part picture of the elephant was *truth* and the other views were *error.* Saxe did not record the elephant's reaction to twelve clutching hands and sixty fumbling fingers, but the resulting squabble of the blind men is mildly famous.

Few people are competent in more than a limited sphere. We live in an age of experts and specialists, requiring the cooperation of many to reach an agreed goal. Field Museum is no exception. We have about as diverse an assemblage of esoteric specialities as exists. The sum total of their activity is Field Museum in society. But what *is* our agreed goal? Along with all institutions, we are reviewing our role in society, our immediate functions, and the allocation of scarce resources among competing needs. Lothar Witteborg speaks from one view. I speak from another segment of Field Museum and focus on a different part of this "allegorical elephant."

What are the unique aspects of Field Museum as an institution? Collections, library, trained staff. Our collections of natural history and ethnographic objects bring scientists and students from all parts of the world to study in Chicago and are utilized on a loan basis by scholars in every continent except Antarctica. Our library is equally fine. Our staff of scientists and technicians makes use of these collections and library resources on a daily basis. Their work cannot be done at an institution without these facilities. Only natural history museums provide them. Universities do not, businesses cannot, only museums can.

Sometimes our research involves immediately relevant problems—medically important ectoparasites of Venezuela or a forest resource survey of Amazonian Peru. Usually we work on basic problems whose practical applications may be decades away or undreamt of at the time of study. The call for work on critical problems of the moment must not blind us from the need to do work that may help solve the problems that arise in the decades to come.

But this is not an attempt to justify the research and collection activities of Field Museum. Our acknowledged function is not just to discover, collect and correlate knowledge, but also to disseminate knowledge. This can be through technical literature, through popular writing, but more directly through the parts of the Museum used by the public—the exhibition halls, the school programs, the public lectures, the traveling school exhibits, and even university level teaching.

What can we offer our audience that other institutions and media cannot? Objects. Natural history specimens and human artifacts. The treasures of the collections and library (the Audubon "elephant" folio naturally comes to mind) can be shared with our audience.

Photographs can be reproduced in books, magazines, and newspapers. Movies and television can show the motion of living creatures and the wonders of foreign lands far better than we can, while the sounds of man and nature also can be spread on that lively anachronism, radio. These media can reach to the smallest town and isolated hollow, or into the heart of urban ghettos. Their offerings are reproducible or transmittable over distances. Our objects mostly are not transmittable or reproducible at a reasonable cost. ' 'any are unique and priceless. The Audubon folio and the huge topaz must stay here. Our audience must come to them.

Our audience. A simple phrase that covers an infinite variety. We have no single audience, but a multiplicity of audiences. Its spectrum goes from the pre-school child to the university professor, from the dedicated amateur specialist to the casual tourist, from the retarded handicapped to the college class.

What have we been offering them? Basically a sampling of nature's variety and the diversity of man's ingenuity in making artifacts. We have halls of "three dimensional color portraits" (habitat groups), halls showing life in past eras, halls showing cultural objects and artifacts, and a few halls that tend towards the textbookish. Rarely de we have more than a fraction of our collection riches shown. No one else has the variety of nature and man's work, no one else can show it. This is and should remain a prime function.

Yet is it enough? Certainly not. When the halls of Field Museum were being filled, the Scopes trial had not been held and evolution was a controversial theory. The overwhelming proof of evolution came from use of specimens such as we specialize in and through work such as our scientists are doing today. These collection resources are uniquely capable of showing stages in the development of the varied living world and man's cultures. Evolution, change through time, is the process that resulted in this diversity. Evolution is a theme that can unify and make sense of the overwhelming diversity that our public halls present. It is not yet being used extensively.

To many people, evolution is old hat. Not modern enough. Not contemporary enough. Pollution, population problems, poverty, and politics engage their minds. They think that museums should address themselves to the solutions of these problems as a knight in shining armour leading the way. As a biologist, I look at the first three "P's" as the inevitable *results* of basic difficulties, symptoms of these difficulties, but not the root causes. I also agree completely wtih the views of Garrett Hardin in "The Tragedy of the Commons" (*Science*, 162:1243-48, 1968) and Beryl Crowe in "The Tragedy of the Commons Revisited" (*Science*, 166:1103-07, 1969) that pollution and population problems are not subject to *technical solutions*. By technical solutions, I mean scientific discoveries, technological improvements, or organizational efficiencies, not requiring profound social, ethical and political changes.

ANOTHER VIEW OF THE ELEPHANT

Growing recognition of the root cause to our problems may prove to be the one significant result from the expensive space program of the last decade. The idea of "spaceship earth," that our planet and its inhabitants form a functioning unit with limited resources, that the actions of a crop duster in Iowa can affect the fisheries in Louisiana bayous, and that we truly are "one world" represents a revolutionary view of man and his future. Few people are ready to accept the consequences of this insight. John Fisher, in an article, "How I Got Radicalized: the Making of an Agitator for Zero" (*Harper's Magazine*, April 1970, pp. 18-29), recently outlined some of them—the impossibility of non-stop growth of any kind, that technology creates at least two new problems for each one it solves, and that destroying our best farm lands for factories and housing is suicidal insanity. All the glorious visions and noble dreams of mankind will be for naught unless we adjust to the limits of our planet.

And herein lies yet another unique capability and possibility for Field Museum to serve society. We can show in environmental exhibits how the world functions. How it is based on energy from the sun, converted by plants and either used immediately (food for animals or decay organisms), or stored for future use (coal, oil and gas, the "fossil fuels"). We can show with our cultural objects and natural history specimens how climate, soil, water, and topography limit the activities and abundance of all species, including man. In other words, museums can interpret the ecology of earth. We are not doing this at present.

Diversity of life and man, its origin through the mechanism of evolution, and explanation of the limits to "spaceship earth" represent three ways whereby Field Museum can be useful to society in disseminating knowledge. Our resources for doing so are limited and the needs in these areas are great. How can we coordinate our efforts with the similar institutions in Chicago and the Midwest—Shedd Aquarium, Adler Planetarium, Chicago Academy of Sciences, Museum of Science and Industry, Hinsdale Health Museum, Milwaukee Museum, Illinois State Museum, etc.? These problems are part of our re-evaluation in search of agreed goals.

While in retrospect it is perhaps simple to distinguish fashion and fad from style and taste, at the time it is not so easy. Remember fins on cars and miniskirts on Michigan Avenue mannequins? The McLuhanesque '60's and the show techniques from Montreal Expo with their slides, sounds, impressions and fantasia of sensory assaults may be a new style or a dying fashion. With the best of will and greatly increased funds, redoing the exhibits of Field Museum will take years of effort once goals are established. To mistake fashion for style will cause infinite problems. To confuse techniques of presentation with the concepts to be disseminated would be tragic.

Remember our diverse audiences. Our exhibits must allow for many levels of interest. For the pre-school child and the functional illiterate—a shape, a color, a pattern, an object. For the grade school child—simple ideas of difference, variety, basic ecology, and object use that will extend their horizons. For the high school student—concepts of relationships, patterns of variety, the overall functioning of our earth. For the adult and collegian—cultural context and influences, mechanics and pathways of evolution, the complexities of our earth. For the casual tourist—exposure to the diversity of nature and primitive societies, the ecology of earth.

These can be our aims, and are within our capabilities. These are things we can do better than others and be useful to society. But we cannot be all things and serve all functions in society. Sociology, economics, technology and contemporary culture are not our bag. Before moving in new directions of current concern, let us pause and make certain that we do not move beyond the bounds of our special capabilities to the neglect of our unique potential. In my view of the "allegorical elephant," fulfillment of these basic useful functions have priority.

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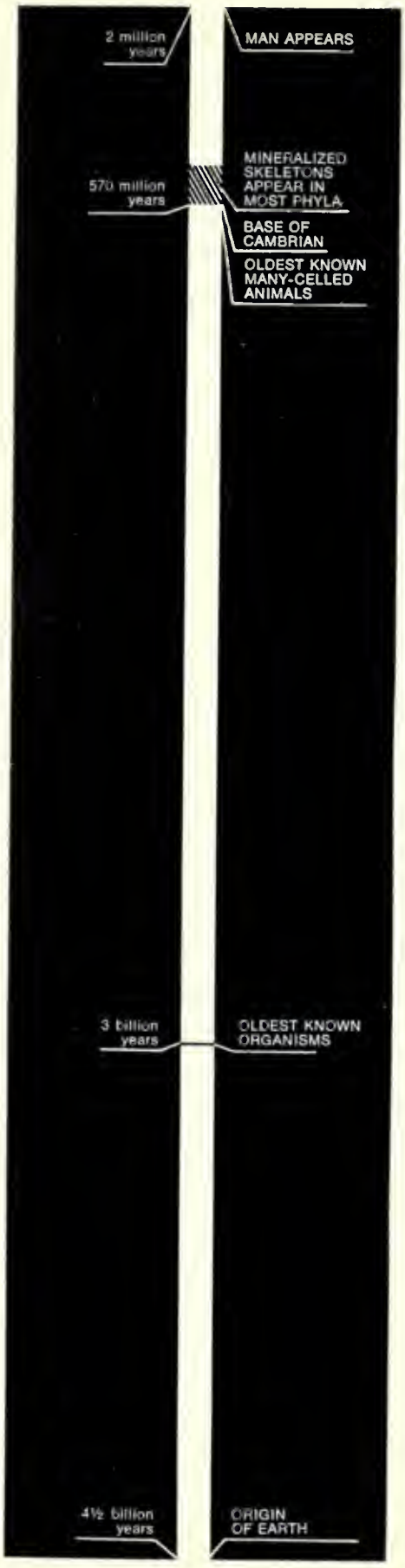


The Origin of Skeletons in Animals

Dr. Robert H. Denison

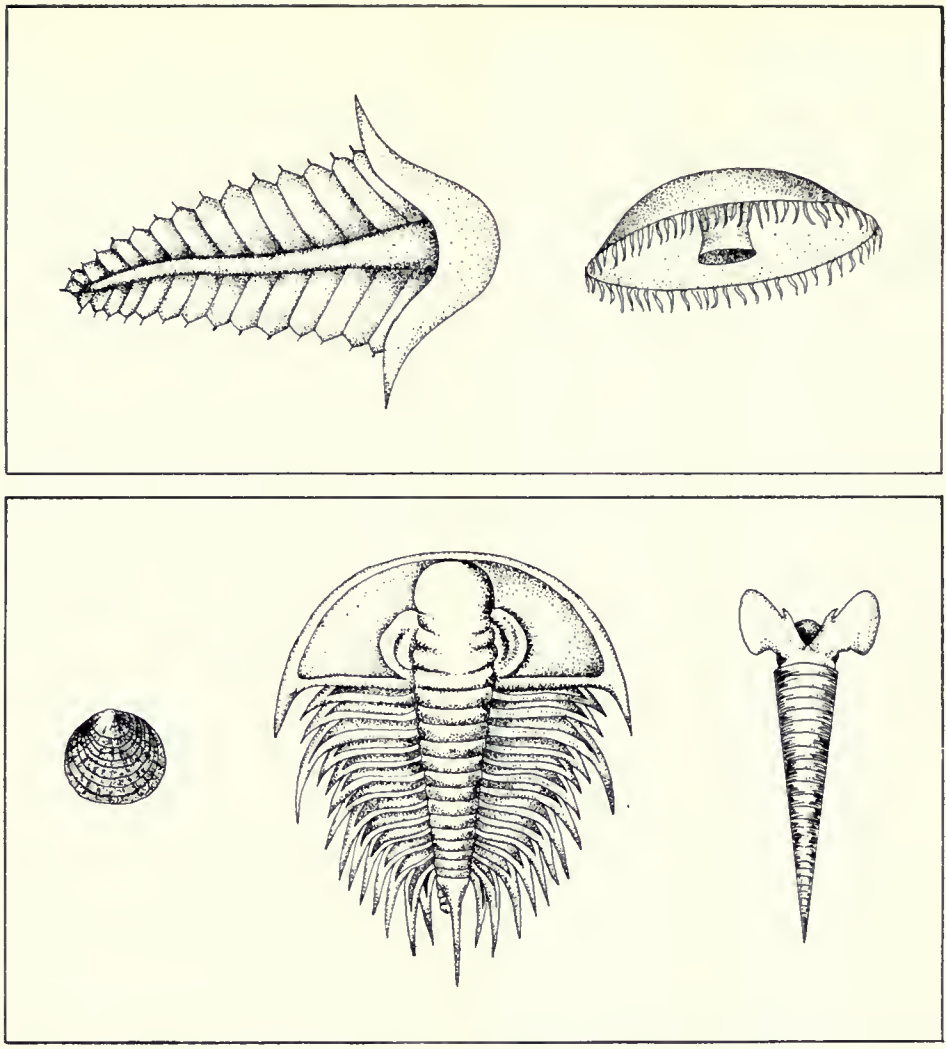
Geologists estimate the earth to be about 4½ billion years old, but it is only in rocks deposited during the last eighth of its existence that there is more than a meager record of the history of life. From the beginning of the Cambrian period, about 570 million years ago, such fossils as sponges, brachiopods, molluscs and trilobites occur in considerable number and variety. In rocks deposited before the Cambrian, fossils are extremely rare, and many of those reported are only doubtfully of organic origin. The largest assemblage of possibly pre-Cambrian animals occurs in Australia in rocks considered by some to be basal Cambrian in age, and consists of impressions of soft-bodied forms such as jellyfish, sea pens, and segmented worms. Plant fossils are known in much older rocks, and include what are thought to be algae and bacteria, as well as stromatolites, which are laminated calcareous structures precipitated by algae.

It has long been a puzzle to geologists and paleontologists why fossils are absent or rare in pre-Cambrian rocks. The complex structure of Cambrian trilobites, brachiopods, molluscs, echinoderms, and others indicates that they had a long previous evolutionary history, but there is no direct record of it. Many theories have been proposed to explain their absence. It has been claimed that the metamorphism to which most pre-Cambrian rocks have been subjected has destroyed all traces of any contained fossils. This is certainly true in many cases, but other pre-Cambrian rocks have been altered only slightly. Some have suggested that the major evolution of animal phyla took place in a long interval between the Cambrian and the known pre-Cambrian. This could be true in those places where there is a very extensive gap representing a period of tens of millions of years when mountains were being elevated and peneplained; but elsewhere there is no major gap before the Cambrian. Another theory states that pre-Cambrian life was restricted geographically or ecologically, and that rocks at that time were not being deposited in the right places to preserve fossils. This cannot be the whole explanation because a wide variety of pre-Cambrian sediments is known. Another view is that the exposures of favorable pre-Cambrian sediments have not been searched thoroughly enough. This may be partly true, but there have been extensive and careful searches, and some recent ones have yielded even microscopic, one-celled algae and bacteria. Finally, there are many who believe that pre-Cambrian animals lacked hard parts, and so were not preservable as fossils except under very unusual circumstances.

There is much support for the last hypothesis. What few pre-Cambrian fossils we know are of soft-bodied creatures, with the doubtful exception of some sponge spicules, and stromatolites, which are to be considered as precipitates induced by algae rather than actual skeletons. If this theory is true, why were hard parts absent in the pre-Cambrian, and why did many different kinds of animals begin to evolve mineralized skeletons and shells early in the Cambrian period? The answer is probably complex, and involves not only the evolution of the

necessary physiological mechanisms, but also the attainment of suitable environmental conditions on earth. Since the early evolution of life probably took place in the sea, some have speculated that pre-Cambrian seas were unsuitable in some way. But the geological evidence indicates that there was no major change in the composition of sea waters near this crucial time nor since, so this theory can be ruled out. Recent students of the earth have concluded that free oxygen was absent from the atmosphere during its early history. This means not only that oxygen was unavailable for respiration by early life, but also that the atmosphere, lands, and upper levels of the waters were subjected to intense ultra-violet radiation. It is thought that free oxygen gradually accumulated in the atmosphere as the result of photosynthetic activity of simple aquatic plants. After millions and millions of years sufficient accumulated, perhaps 1% of the present amount, so that oxygen respiration was profitable, and a layer of ozone formed a partial shield against ultra-violet radiation. This was a crucial time in the history of animal life, for oxygen respiration made possible the evolution of multi-celled animals, and many new habitats became suitable for life. Some would place this event at the end of pre-Cambrian time, and picture a period of explosive evolution leading rapidly to the early Cambrian fauna. Others would place it perhaps a half a billion years earlier, allowing more time for the gradual evolution of the many phyla which appear first in the Cambrian. In any case, it had certainly happened before the early Cambrian faunas appeared.

An animal relies on its external environment, presumably the sea in Cambrian times, to provide the necessary chemicals for its skeleton or shell. These it must store, concentrate, and transport to the correct place in the body for skeletal formation. The actual mineralization is not a simple process. Probably all multi-celled animals have certain cells that first produce an organic matrix in which the mineral will be deposited. This matrix consists of an oriented, usually fibrous, material in a ground substance. The fibers are complexes of proteins and



Pre-Cambrian animals were soft-bodied forms like this worm and jellyfish (top illustration). The bottom illustration shows early Cambrian animals with shells, including brachiopods, segmented trilobites, and molluscs with long tapering shells.

Illustration by Zbigniew T. Jastrzebski

carbohydrates, mostly collagens and chitins, and the ground substance is a viscous colloid consisting of proteins and carbohydrates also. The actual process of mineralization is not well understood, even though it is being intensively studied in recent animals, but it is thought by many that the organic matrix in some way induces the formation of the crystals of the mineralizing skeleton. In any case the physiological mechanism is complex, and it is possibly the evolution of this, as well as the attainment of favorable, external environmental conditions, that delayed the evolution of mineralized skeletons until the Cambrian.

When hard skeletons did evolve, they did not appear abruptly in all groups at the beginning of the Cambrian. A number of major groups are not known until the middle or upper part of the Cambrian period, and others, notably vertebrates, are first known in rocks of Middle Ordovician age. Thus, the known first appearance of most phyla and many important classes of animals ranges over 100 or more millions of years. If this is a short period compared to the history of the earth, it is a significant segment of the history of animals, and the origin of mineralized skeletons cannot be described as sudden.

Though the general mechanism of skeletal formation may have been similar in all multi-cellular animals, there were many differences in details. The structures produced differed as widely as the internal skeleton of a mammal and the external shell of a mollusc. The minerals of which the

skeleton was constructed were varied. Vertebrates built their skeletons largely of calcium phosphate, in the form of the mineral hydroxyapatite, with minor amounts of other substances such as calcium carbonate. A number of invertebrates, such as the brachiopod *Lingula*, and some arthropods and worms, also developed phosphatic skeletons. The majority of invertebrates used calcium carbonate in their skeletons, and a few tried silica, though this was never very popular. What determines the skeletal material is not definitely known. It may depend on the nature of the organic matrix, and it is surely related to the concentration of minerals in the body fluids.

We have considered when and how animals acquired mineralized skeletons, and now we must consider why. What functions did they serve, and what advantages did they provide? Perhaps the most obvious function of a skeleton is to provide mechanical support for the other tissues, but this is not essential especially for an aquatic animal, and many get along without one or without a rigid one. However, rigid attachments for muscles permit more efficient and rapid locomotion, and they permit the evolution of a strong biting mechanism, necessary for a predator. Many groups of animals early acquired an external skeleton in the form of a shell or carapace. Such a skeleton would serve as a protective armor against predators, and perhaps against the rigors of a harsh environment, such as the waves on a sea shore. It has recently been suggested that external skeletons may have served to shield their owners against ultraviolet radiation; however, this may not have been necessary by the Cambrian period, and we know that many Cambrian animals got along well without such a skeleton. Many early skeletons were heavy and increased the specific gravity of their possessors. This might be an advantage to a bottom dweller, but would be disadvantageous to an active swimmer, and for this reason some animals reduced or lost their external skeletons. One important function of a mineralized skeleton is physiologic. In vertebrates, bone serves to store the calcium and phosphate that is needed in metabolic activity, these ions being withdrawn as needed and later replaced. This storage is absolutely necessary to a land animal whose internal environment must be maintained independently of changes in the external environment, but it is of less importance in marine animals, for many of their chemical needs are supplied by the sea water. However, the sea contains very small quantities of phosphates, so they must be stored by all active animals, by vertebrates in bone as well as in body fluids. There are some who think that this was the primary function of the vertebrate mineralized skeleton, but there is evidence that this was a minor function in their early history, only later becoming of major importance.

Whatever functions they served, it is probable that skeletons evolved rapidly as a result of their selective adaptive value. As a result, we have an early fossil record of new groups in the Cambrian and Ordovician becoming visible as they evolved mineralized skeletons and successfully competed for the many available ecological niches.

Dr. Robert H. Denison is Curator of Fossil Fishes, in Field Museum's Department of Geology.

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GALAPAGOS NATURALIST, with both Galapagos tours and in Ecuador, Francisco Leon Rodriguez, formerly of the Darwin Research Station and now zoologist with Universidad Catolica in Quito.

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Poisonous Holiday Plants

Dr. Johnnie L. Gentry, Jr.

Poinsettia and a sprig of mistletoe above the doorway are Christmas traditions we all enjoy. Although these plants are widely used for decorative purposes, many people are unaware of their poisonous properties.

Poinsettias are the most popular and characteristic plant of the Christmas season. It is a symbol of the holiday, and the red bracts (modified leaves) and green leaves carry out the familiar complementary colors of the season. The showy red portion of the plant, popularly referred to as the petals of the flower, consists of modified leaves. These bracts surround a cluster of small and inconspicuous yellow and red flowers. In addition to the red varieties, white and pink varieties are also available.

The first poinsettias were probably introduced into the United States from Mexico in 1825 by Joel R. Poinsett, the first United States Minister to that country. After supplying his own gardens, he distributed plants to his horticultural friends and to some botanical gardens in the East. The botanical name (*Poinsettia*) given to the plant was changed, but the common name continues to honor the man who brought it into cultivation. In Mexico the plant is called *flor de la noche buena* (the Christmas Eve flower or flower of the Blessed Night).

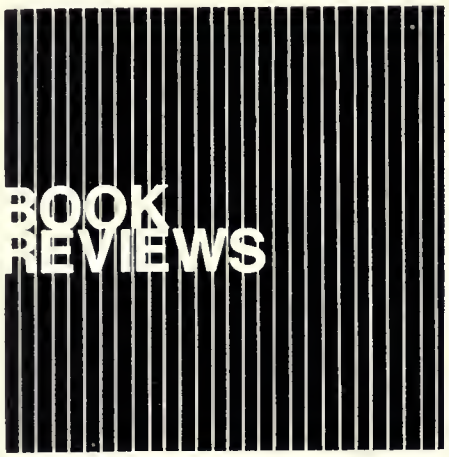
Poinsettias may cause dermatitis if the milky sap comes in contact with the skin and may produce severe gastric problems if eaten. It has been responsible for deaths among children.

Mistletoe has been very appropriately named the thief tree (*Phoradendron*) from the Greek *phor,* thief, and *dendron,* tree, because of the parasitic habit. The mature plants are rather bushy in appearance and one to three feet across. Mistletoe is not cultivated, but is collected from the trunks and branches of various deciduous trees for the attractive evergreen leaves and waxy-white berries. The seeds are disseminated almost entirely as a result of being eaten by birds. It is unknown from our immediate area, but can be found in southern Illinois and southern Indiana.

Early in history people gave special regard to the mistletoe, for it is mentioned in the earliest legends. Mistletoe was used for several purposes, such as a scourge for witches and a talisman to secure good harvest. The custom of kissing under the mistletoe came from the Norse legend of Balder, the sun god, whom, legend has it, was shot with an arrow of mistletoe. The association of mistletoe with Christmas is a sentimental one brought by our European ancestors to America and associated here with a similar American plant.

Deaths have occurred from eating mistletoe berries. Fatalities have also been reported from drinking a tea brewed from the berries in an attempt to secure an abortion.

Dr. Johnnie L. Gentry, Jr. is Assistant Curator of Botany at Field Museum.



Nature in Print: The Big Books

Books on natural history have had a long and fascinating history. One of the high points in that history occurred in the late 18th and 19th century. During that time a large number of books lavishly illustrated with colored plates were printed. These plates were produced by skillful engravers, and after printing were patiently colored by hand. The names of some of the painters whose work the engraver copied have since become famous. Field Museum's recent acquisition, Audubon's *The Birds of America,* represents one of the crowning achievements of this genre. These books were usually issued by subscription that only the wealthy could afford. This tradition, a half-way house between art and science, did not survive the nineteenth century.

I believe that we are experiencing another episode in the history of illustrated nature books at the present time. Today's tomes may never be ranked with the works of Audubon, but they are visually sumptuous and many represent the work of skilled artists. These are 20th century books and these 20th century artists are photographers. Just as Audubon required skilled engravers to transfer his art to the printed page, today's photographers are served by the recent advances in photo-engraving and color printing. The first successful book of this type was Eliot Porter's *In Wildness is the Preservation of the World.* This was the first all-color book published by the Sierra Club in 1962 ($25). Its success can be measured by the fact that it now has been issued in paperback (Ballantine, 1967, $3.95) and has been followed by a host of similar volumes.

This success cannot be considered apart from the extraordinary sales, in recent years, of other big picture books. Apparently, affluent Americans had too many barren coffee tables (these books are too tall for most library shelves). Or perhaps these big books make ideal gifts; they cost enough to impress people and reflect the giver's excellent taste at the same time. I believe that these large books dealing with nature stand apart from the others. They are not another edition of famous paintings or another collection of art objects. The books I am discussing represent original work by photographers concerned with capturing nature on film.

Appalachian Wilderness by Eliot Porter (E. P. Dutton & Co., 1970, $25. before 1/1/71) is the latest book by America's most gifted photographer of natural scenery in color. Eliot Porter can see beauty where others pass, not pausing. His camera captures broad vistas, a grove of trees, or a small area of the forest floor, all with a clarity that only photography can achieve. The pictures are arranged in sequence with the seasons, beginning in Spring and ending in Winter. Porter's photographs often lack strong compositional design, gaining their impact from an array of detail—like a Persian rug or a painting by Jackson Pollock. The book is well bound and the layout is excellent, but text and captions are poorly differentiated. The text, by Edward Abbey, is a dismal inventory of billboards and other sins. This is the eighth book (by my count) illustrated by Eliot Porter and, I think, one of his best.

While the photographs are superbly reproduced, a few exhibit rather unnatural greens—something seen in other books by Porter and probably due to the film he uses. Porter uses a large camera on a tripod, excellent for scenery, but rarely capturing an animal or close-up. Photographers have a style, and the carefully composed, exquisitely detailed view is the style of Eliot Porter.

As the big-picture-book bandwagon rolls on we can hope to see the work of more nature photographers and a greater variety of styles. The Sierra Club has just published a book on the Everglades, photographed by Patricia Caulfield (1970, $27.50). Closer to our area is *Superior, a Living Lake* (Harper and Row, 1970, $22.50 until December 21, $25 after) with an exciting variety of photographs by Charles Steinhacker. Perhaps a publisher will present us with the recent work of Jeannette Klute. This photographer uses a large camera for close-ups, usually with very little depth of field. The resultant pictures, largely out of focus, often achieve a dream-like quality, a style utterly different from that of Eliot Porter.

Another group of natural history books featuring excellent photography and fine printing concern themselves with more specific subject matter. *The World of Bats* (Holt, Rinehart, and Winston, 1970, $23.95) has many extraordinary photographs by Nina Leen in color and in black and white that capture these elusive creatures in many of their life activities. There is even a sequence showing a fishing bat catching a fish. The text by Alvin Novick is a detailed discussion of the biology of bats. In contrast, completely static subjects have been exquisitely photographed by H. Landshoff in *The Shell, Five Hundred Million Years of Inspired Design,* by Hugh and Marguerite Stix and R. Tucker Abbott (Abrams, 1968, $25). Here too, the photographs are in black and white as well as color and both media are used to excellent effect.

I have mentioned only a few of the photographers whose work is presented in these superbly printed books. If you haven't done so already, sit down with one of these books. They can be a welcome respite in a busy schedule and enhance your appreciation of nature as well.

The following books are available in Field Museum's Bookshop: In Wildness is the Preservation of the World *and* Appalachian Wilderness, *Eliot Porter;* Superior: Portrait of a Living Lake, *Charles Steinhacker;* The Shell, Five Hundred Million Years of Inspired Design, *Hugh and Marguerite Stix and R. Tucker Abbott.*

by Dr. William C. Burger, who is on the staff of the Botany Department at Field Museum and a member of the Nature Camera Club of Chicago.

FIELD BRIEFS

Holiday Science Lecture Series

More than 800 top high school science students have been invited to attend the Holiday Science Lecture Series on December 29 and 30. Dr. Thomas Eisner, professor of biology at Cornell University, is guest lecturer at the four sessions. His subject is "To Be An Insect."

The lectures include "To Speak With Friends," "To Survive Attack," "To Depend On Plants" and "To See the Invisible," and will be followed by a question and answer period.

This is the ninth consecutive year for the series, sponsored by Field Museum and the American Association for the Advancement of Science. The lectures will be held at 10:30 a.m. and 1 p.m., James Simpson Theatre.

Director Appointed to Arts Council

Museum Director E. Leland Webber has been appointed to the National Council on the Arts by President Richard M. Nixon. Created by act of Congress in 1964, the National Council is composed of the Chairman of the National Endowment for the Arts, Nancy Hanks, and 26 citizens who are widely recognized for their broad knowledge of the arts or their profound interest in the arts. The Council advises the Chairman on policy, programs and procedures, and reviews all applications for financial assistance made to the National Endowment, an agency of the Federal Government.

Other persons recently appointed to the Council include Maurice Abravanel, conductor and musical director; Kenneth N. Dayton, corporate executive; Charles Eames, designer and film producer; Virginia Gerity, opera guild president; James Earl Jones, actor; Charles K. McWhorter, attorney; Beverly Sills, coloratura soprano and Robert E. Wise, producer-director.

In announcing the appointments, President Nixon issued the following statement: "The arts are playing an increasingly significant part in American life, not just in the few great centers but throughout the Nation. When I asked Congress last year to extend the life and substantially increase the funding of the National Foundation on the Arts and the Humanities, I noted that: 'The arts have attained a prominence in our life as a nation and in our consciousness as individuals that renders their health and growth vital to our national well-being.'

"The National Council on the Arts will have a key role in determining how Federal funds are to be used in order to bring more artistic enrichment into the lives of more people in more places. In a broader sense, the Council will be addressing itself continually to the question of how the Federal Government can best assist the arts and encourage the vital sources of private support."

E. Leland Webber

Earth Science Course

Field Museum's Department of Education in cooperation with the University of Chicago Extension is offering a ten-week non-technical evening course concerning the problems and questions of earth sciences. The course will emphasize studies in geology and paleontology, dealing primarily with the structures, histories and the theories of the development of the earth and the life upon it. The course will begin on January 13 and will be conducted by Dr. Edward Olsen, curator of mineralogy, and Dr. Matthew H. Nitecki, associate curator of fossil invertebrates, in Field Museum's Department of Geology.

For further information, tuition cost, and registration forms please write or phone Mrs. Maria Matyas, University of Chicago, Downtown Center, 65 East South Water Street, Chicago, Illinois, 60601, FI 6-8300.

Dr. Robert H. Denison to Retire

Dr. Robert H. Denison, curator of fossil fishes in the Department of Geology, retires at the end of the year. During his 22 years at Field Museum, he has been responsible for enlarging the Museum's collection of fossil fishes to one of the best in the country, gathering almost the entire collection of primitive vertebrates himself.

Dr. Denison's research has been centered on the Ordovician, Silurian, and especially the Devonian period. He has provided new information and contributed enormously to the available knowledge of this important area in time—the very base of vertebrate life on earth. He has also authored numerous scientific articles in *Fieldiana* and other publications. His "A Review of the Habitat of the Earliest Vertebrates" (*Fieldiana: Geology*, Vol. 11, No. 8, 1956) carefully reviews all data and concludes that "vertebrates originated in the sea and did not begin to enter fresh waters until some time in the Silurian." He has been joined in this opinion by most American paleontologists.

Based on extensive investigations, Dr. Denison has offered the earliest evidence of lungs in vertebrates. His many field trips included Norway, Sweden and Great Britain as a Guggenheim Fellow.

A Fellow of the Geological Society of America, Dr. Denison is also a member of the American Society of Zoologists and the American Association for the Advancement of Science. He is a past president of the Society of Vertebrate Paleontology.

Dr. Denison's future plans include continuing his current research on the early and middle Paleozoic fishes, writing, and work in paleo histology.

CALENDAR

Hours
9 a.m. to 4 p.m., Monday-Thursday
9 a.m. to 9 p.m., Friday
9 a.m. to 5 p.m., Saturday and Sunday
Closed Christmas Day

The Museum Library is open
9 a.m. to 4 p.m.
Monday-Friday

Begins December 1
"Exploring Indian Country," Winter Journey for Children. The self-guided tour helps youngsters to see American Indians of three environments as the early explorers saw them. All boys and girls who can read and write are welcome to participate in the free program. Journey sheets are available at Museum entrances. Through February 28.

Continuing
A Child Goes Forth, an exhibit of toys and games from around the world, examines the role of these objects in the cultural development of children. Hall 9.
Corn Blight, an exhibit of current interest, shows the effects of a virulent new strain of Southern Corn Leaf Blight disease. Authorities predict an 18% decrease in the nation's 1970 corn crop because of this disease. Through January 18. South Lounge.
75th Anniversary Exhibit: A Sense of Wonder, A Sense of History, A Sense of Discovery, offers a unique viewing experience. Innovative photographic and display techniques explore Field Museum's many facets. Hall 3.
John James Audubon's elephant folio, *The Birds of America,* on display in the North Lounge. A different plate from the rare, first-edition set is featured each day.

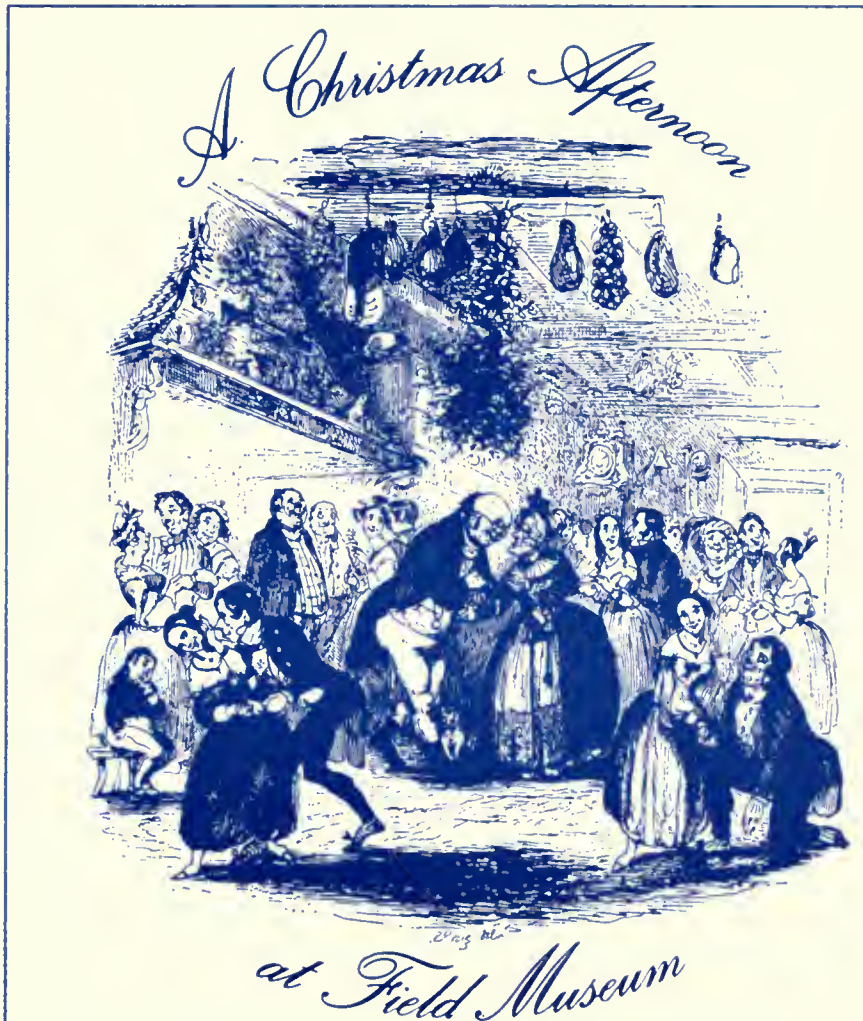
December 1-January 3
Self-Guided Tour, "Winter Greens," designed to acquaint visitors with plants that are popular during the Christmas season. Free tour sheets are available at Museum entrances.

December 27
Free demonstration-lecture, "Measuring Air Molecules," or "Why should people believe what scientists tell them about molecules and atoms?" by Dr. Eric M. Rogers, professor of physics at Princeton University. 3 p.m., James Simpson Theatre.

December 28-31
Free Film and Guided Tour Program, "Through These Doors," a color film, is presented at 1:15 p.m. in the 2nd floor North Meeting Room. A "highlights" tour leaves at 2 p.m. from the North Information desk.

January 3
Free Wildlife Film, "Scandinavian Saga," offered by the Illinois Audubon Society. 2:30 p.m. James Simpson Theatre.

Meetings
January 6, 7 p.m.
Illinois Audubon Society
January 10, 2 p.m.
Chicago Shell Club
January 12, 7:45 p.m.
Nature Camera Club of Chicago
January 12, 8 p.m.
Chicagoland Glider Council
January 13, 7 p.m.
Chicago Ornithological Society
January 13, 7:30 p.m.
Windy City Grotto—
National Speleological Society
January 14, 8 p.m.
Chicago Mountaineering Club



music for dancing entertainment refreshments
4 p.m. to 7 p.m., December 21

Please send me _____ adult tickets $10 _____ child (under 14) tickets $5
Name_____
Address_____

For information or reservations please call the Women's Board, 922-9419.